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EXECUTIVE SUMMARY OF ENVIRONMENT, SOCIO-ECONOMIC BASELINE STUDIES CONDUCTED IN ONON RIVER BASIN

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2010

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FOREWORD

The negative changes on the environment and loss of natural resources that would bring destruction to the human beings have become a big concern for all the countries around the world within last semi-hundred years. Consequently, the countries in the world have started to seek for and deal with more innovative ways and approaches in terms of the environmental conservation and sustainable use of natural resources.

For Mongolia, much effort has been initiated and undertaken in this field. For example, throughout the country 29 river basins have been established in accordance with the Mongolian Law on Water revised in 2004 and the State policy on river basin-wise approach for sustainable use and protection of water resources has been developed and implemented in practice. Additionally, within the framework of the Millennium Development Goals Based National Development Comprehensive Policy, the Government of Mongolia approved the national programme on water that includes a number of important tasks and actions e.g. to prevent from potential water resource shortage, accumulate surface water and properly use it for other development sectors, and create and renew the water infrastructure for Mongolia, which has natural formation that is extremely vulnerable to climate change.

The concept of national security of Mongolia includes the statements on protection and sustainable use of water resources and introduction of water basin management system, where usable surface and ground water resources are established for utilization in each basin without loss of the ecosystem ecological balance and the water resource utilization is strictly adhered to the established amounts in the basins.

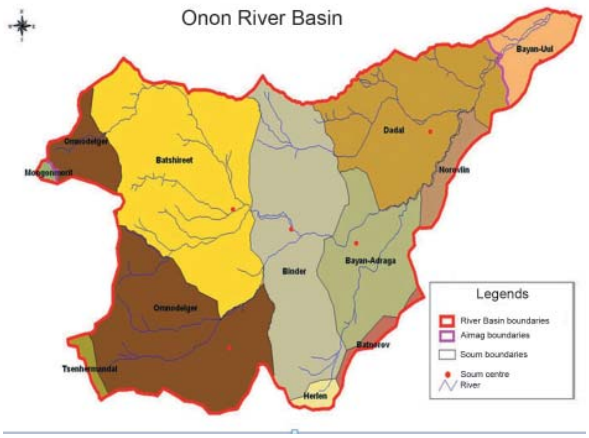
With the purpose to support the implementation of policy documents above, an integrated water resource management plan for Onon river is being developed within the scope of Poverty Reduction through Community Based Natural Resource Management project that is implemented by the Ministry of Nature, Environment and Tourism and WWF Mongolia Programme Office with funding of Japanese Poverty Reduction Fund.

The management plan entirely covers Onon River Basin. In order to collect necessary data and information and predict the future tendency, totally 18 thematic studies were conducted by the Water Research and Development Institute and Research Center for Agricultural and Environment Economics within two main chapters: hydrology, ecological-legal framework, institutional structure, and capacity and socio-economic status.

In order to assist the Onon River Basin Council and local government institutions in development of management plan containing scientifically based and reachable/ attainable goal and objectives through the consideration of water issues at the Basin level, this executive summary of baseline studies and their findings is being presented.

JUSTIFICATION

To date, a number of water resource conservation, restoration, and sustainable use targeted actions are being initiated and organized with a focus on prevention from water resource shortage either Mongolia or many other countries in the world. Like other countries in the world, Mongolia has strategically important objectives to prevent from water resource pollution and shortage, to use it in sustainable way, and provide human populations with hygienically clean and safe water within the frame of prioritized areas of the Millennum Development Goals Based National Development Comprehensive Policy.



One of the most important factors to implement these strategically important objectives is to develop integrated water resource management at the Basin level and implement it in participation of local and regional governments, direct and indirect water users and consumers within the Basin.

Moreover, the Government has commenced a Basin targeted water resource conservation and sustainable use approach through having divided entire territory of the country into 29 basins within a framework of the Mongolian Law on Water revised in 2004. Currently, totally 13 River Basin Councils have been established and one of them is Onon River Basin. Onon River Basin Council was established by the Nature, Environment and Tourism Minister's Decision No: A-108 dated April 19, 2010.

Studies on climate, water resource and quality, hydro-geology, soil, water consumption, legal and regulatory framework, and hydro-ecological research, parts of baseline studies, required for development of integrated water resource management plan for Onon River Basin were carried out by a research team consisted of the following members:

1. Team leader: D. Chandmani /Ph.D/ and Consultant-Engineer of Mongolia;
2. Advisor to the research team: Ts. Balgandorj /Ph.D/ and Consultant-Engineer of Mongolia;
3. I. Baldangombo, Researcher of water consumption and hydro-technician-engineer;
4. N. Jadambaa, /Sc.D/ Ground water researcher;
5. G. Bayasgalan, /Mcs/meteorologist;
6. D. Ouynbaatar, /PhD/, Surface water researcher;
7. D. Saikhanjargal, Surface water researcher;
8. Ch. Javzan, /Ph.D/, water quality researcher;
9. U. Tsedendash, /Ph.D/, forest researcher;
10. A. Buyanbaatar, /Ph.D/, soil researcher;
11. P. Ariunsuren, /Ph.D/, Botanist;
12. J. Puntsagdulam, /Ph.D/, insectologist;
13. S. Shar, /Ph.D/, Wildlife Researcherr;
14. Ch. Uuganbayar, /Mcs/, Ornithologist;
15. M. Erdenebat, /Ph.D/, Ichtiologist;
16. Ts. Tsetsgee, /Mcs/, Lawyer and Researcher;
17. Ser-Od, /Mcs/,GIS;
18. S. Naranzul, Finance Officer;

The socio-economic studies were conducted by the Research Center for Agricultural and Environment Economics with the following team members:

1. Research team leader: A. Bakei, /Ph.D/ and Professor;
2. L. Nyambat, /Ph.D/and Professor;
3. B. Purev, /Ph.D/and Professor;
4. D. Lkhagvasuren, /MBA/
5. D. Kaderbek, /MBA/

STUDIES ON HYDROLOGY, ECOLOGY, AND LEGAL AND REGULATORY FRAMEWORK

ONE. CLIMATE AND ITS CHANGE

Established in December, 1953, the first meteorological observation station started meteorological data collection and analysis in Onon River Basin. Currently, there are three meteorological stations and six guards collecting meteorological data in Basin. Annual average air temperature within Onon River Basin is -0.6-1.5°C, however it reaches -4°C in the northern part of Basin. Annual total precipitation is 320-400 mm; however precipitation is more than 450 mm in the northern part of Basin. Relative humidity rate is 60-65%, mean wind velocity is 2-3 m/s and days with more than 10 m/s are 20-30 in average[1] . In 1954-2000, annual total precipitation was reduced by about 12 per cent, the precipitation amounts in summers and springs were was reduced by 16 per cent 18 per cent respectively. Whereas, the precipitation amounts in autumns and winters were increased by 10 per cent and about 20 per cent respectively. About 90 per cent of annual total precipitation occurs in April to September, which is regarded as warm season.

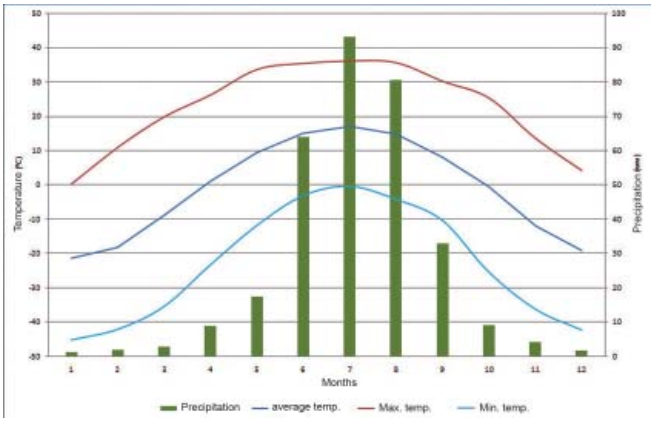


Figure 1.1. Climate related data

In 1954-2009, the annual average air temperature was increased by 2.09°C that included 1.98°C in summertime and 0.92°C in wintertime.

The human activities contributing to global warming is the intensive exploitation and consumption of some minerals e.g. coal, oil, and natural gas that discharge considerable amounts of carbonic acid gas into atmosphere. Human activity impacts contributing to global warming are found initially within limited areas such as cities and other settled areas, and then within regions, and ultimately throughout world.

According to the data and statistics collected on daily basis from 1961 to 2009 by the meteorological stations located in Onon River Basin, the number of hot days were increased by 22-23 days, the number of cold days was reduced by 16-17 days, and the precipitation amount was reduced while compared against 11 indexes[2] suggested by the world meteorological organization for identification of global climate change tendency. Particularly, the number of hot days with 90 per cent rate was increased by 3-4 days and growing season duration was expanded by 16-19 days. Total precipitation was reduced by 3-37 mm and the precipitation with 95 per cent rate was reduced by 10-20 mm. Air temperature in Onon River Basin is getting increased almost by three times compared to the changes in air temperature of northern hemisphere of the globe.

According to the data and findings of HadCM3 model developed by Hadley Centre of Meteorological Office, United Kingdom, the warming process is relatively higher in summertime in compared to that in wintertime. It is expected to be inceased by 2.4-3.3°C in 2011-2030, by 3.0-4 .5°C in 2046-2065, and by 3.4-6.1°C in 2080-2099. Nevertheless, it is expected to be increased by 1.6-2.2°C, 2.0-2.7°C, and 2.8-3.3°C in wintertime respectively within the above specified years.

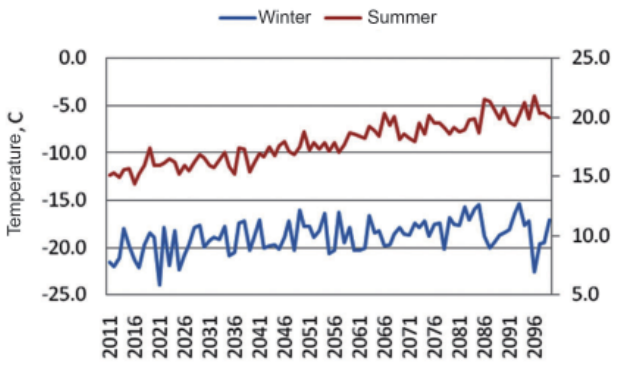


Figure 1.2. Changes in annual air temperatures including summer and winter time air temperatures (0C)

Due to impacts of ongoing climate changes, the dryness is likely to be intensified despite the winter coldness relatively smoothened and precipitation particularly in summer time relatively higher in Onon River Basin.

TWO. STUDIES ON SOIL

According to the soil province classification, Onon River Basin lies in Khentii region of Khangai great region. In terms of its geographical location, the Basin supports main Khentii mountain range and its con-

[1]Ministry of Nature, Environment and Tourism of Mongolia, 1988
[2]http://cccma.seos.uvic.ca/ETCCDMI/software.shtml

tinued mountains in different directions that gradually meet low mountains and rolling hills and steppe. Back slopes of mountains, namely up to 1400 m of absolute height, are distributed by dark brown and brown soils, the slopes at 1400-1600 m by mountainous black dirty soil, and slopes above (1800-2200 m) by mountainous forest gray soil. While the mountainous tundra forests are distributed by powdery soil, the mountain flat tops are distributed by mountain meadow peaty thin soil. However, the bare slopes of mountains and Khentii mountan range (from bottom to upward) are distributed by brown and dark brown soils and then gradually replaced by black dirty soil. At 1600-1700 m, these types of soils are replaced by semi-alpine mountain meadow black dirty-like soil.

The valleys and depressed areas belonging to this soil province are widely distributed by black brown, brown, meadow brown and low land dark soils that are much suitable for farming or cultivation. River floodplains, narrow valleys and bottoms of canyons are abanduntly distributed by swampy and meadow swampy soils.

The Basin is dominant with the brown dirty soil and dry steppe and steppe soils that belong to the steppe and valley category but limited by the mountain steppe black dirty soil that belongs to the mountain soil category according to the soil classifications in Mongolia. More common characteristics of the Basin soils include: soil layers are thin, entirely not so dense, non-carbonate, and gypsym bearing in some areas, small sandy and gravely pieces are dominant in soils, and water catching or bearing capacity is below the intermediate (Figure 2.1).

Onon River Basin is dominant with mountain non-carbonate weakly developed brown and floodplain black brown and brown soils. Thus, salinification is relatively lower in irrigated farmland and gypsym bearing soil in some areas contributes in soil neutrolazation. Within Onon River Basin, totally 425 ha area has become saline and swampy. The rest of area in the Basin is free of salinification and getting swampy.

Soils distributed within Onon River Basin are not dense and have mostly light clayish mechanic compositions. These types of soils are much suitable for cultivation and easy to handle earth work (e.g. it requires less force); however they have low water catching or bearing capacity because of small gravel and rock pieces.

Due to overgrazing, top soil structure has been lost in quite large areas within Onon River Basin (within about 5000 hectare according to field work observations and unpublished research notes). For instance, some parts of farmland or cultivation land in Khurkh bag of Umnudelger soum have had sand and small pieces of gravel/rocks in their soils. It shows that the areas have been affected by wind erosion.

Therefore, particular attentions need to be paid to expansion of irrigated farmland and optimization in farming or cultivation productions. The current cultivation practice, in which quite large areas are cultivated, but small yields or harvests are obtained, is not a right solution in terms of ecological and economic values. Researchers consider that totally 5381 ha areas within Onon River Basin may be used for irrigated cultivation/farming business. Since the Basin supports different types of soils including the soils rarely found elsewhere in the world, a museum of soils may be established based on the historical sites as a part of eco-tourism.

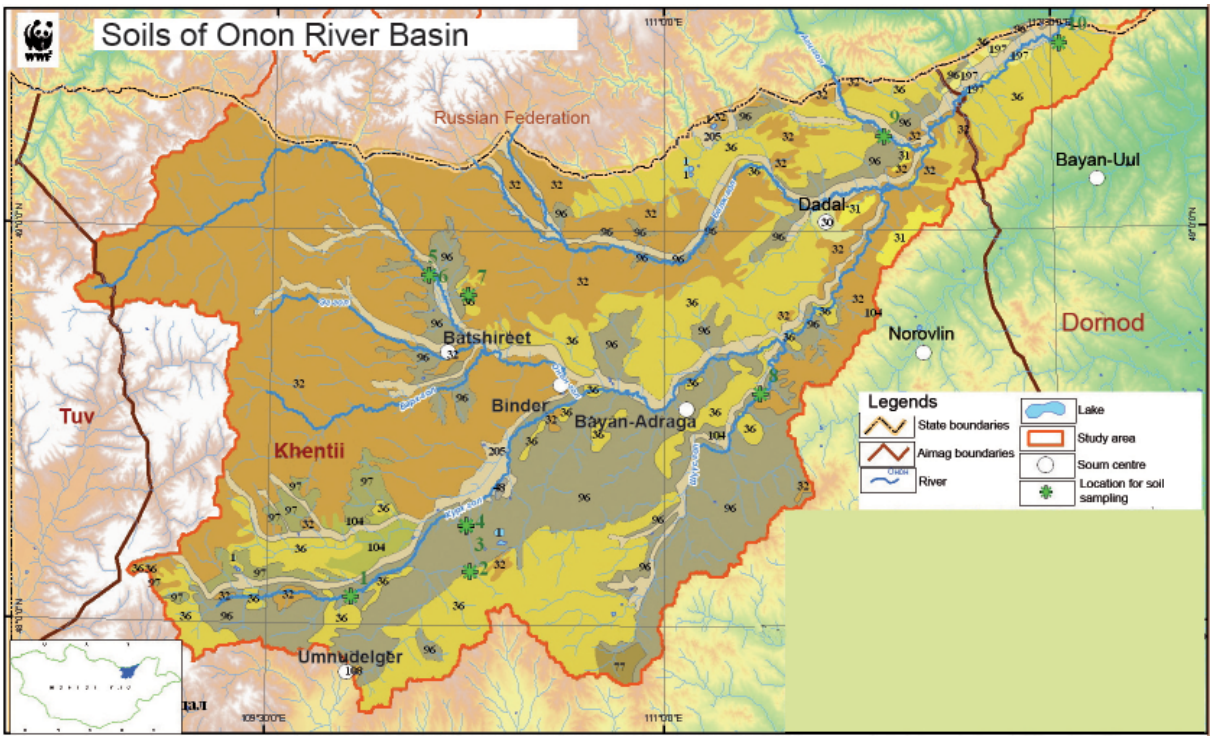


Figure 2.1. Soils of Onon River Basin

THREE. STUDIES ON SURFACE WATER

River Basins have usually clearly defined watershed lines. Rivers' network is the most well-ordered and well-arranged system in the world and provides a basis of systematization of natural resource use and conservation practices.

Originated from nearby a hot mineral water body "Onon" in the north-east of Khentii mountain range, Onon river runs for totally 808 km long distance and has 94040 km^2 water catchment area. Out of them, 575 km and 29070 km^2 water catchment area exist in territory of Mongolia. The River Basin supports totally166 rivers and streams and 47 lakes and ponds (River inventory, 2007).

As the river originates from a mountain, its water is sharply fallen down and has quick or speedy currents. In its some parts, the current speed reaches 1.5-2.0 m/s, but it is gradually reduced to about 1.0 m/s below Balj tributary. Agats, Balj, Eg, Barkh, and Jargalant rivers, main inflowing rivers, run through steep slopes of mountains in mountainous areas.

In Onon River Basin, the first permanent hydrological observation guard/point was established in Binder Soum in 1942. Since then, it has been expanded into a network of surface water observation and measurement. To date, there are totally seven hydrological observation guards/points including five hydrological observation guards of Onon river and its inflowing rivers e.g. Khurkh, Eg, Barkh, and Balj rivers and a guard of Gurvan lake in the Basin.

Establishment of hydrological observation guards on big rivers inflowing into Onon river.

Annual average run-off of Onon river is 32.9 m^3/sec in the vicinity of Binder soum and 56.4 m^{3}sec in the vicinity of Dadal soum. These figures show that the river run-off has less loss along its straight line. Long term average run-off of the rivers inflowing into Onon river fluctuate between 1.5-12.6 m^3/sec.

Table 3.1. Long term average run-off of some rivers inflowing into Onon river

Д.д	Rivers and lakes	Water catchment area, km^2	Long term average run-off		
			m^3/sec	mm	km^3
1	Onon-Binder	8810.0	32.9	105.0	1.01592
2	Onon-Dadal	25060.0	56.44	69.8	1.74283
3	Khurkh-Khentii brigade	1520.0	1.50	30.8	0.04625
4	Eg-Batshireet	987.0	2.76	47.4	0.04625
5	Barkh-Batshireet	1871.0	5.16	86.2	0.15947
6	Balj-Dadal	3698.0	12.63	106.6	0.39001

Maximum amounts of water flows from melting snow/ice and rainfall flooding water reach 255-904 m^3/sec along Onon river and 45-70 m^3/sec along the rivers e.g. Khurkh and Eg.

15.5-31.1 per cent of annual run-off of Onon river is fed by ground water, the 6.5-12.7 per cent by water flows of melting snow/ice, and the 56.5-71.8 per cent by rainfall. Depending on annual hydraulic/rainfall amounts, the majority or 81.4-97.7 per cent of Onon river annual run-off is recorded as in spring and summer (April to September) including 9.5-14.8 per cent in spring (April to June).

Maximum run-off is recorded in upper side of river in springs, but it is found in the middle part of river in summers.

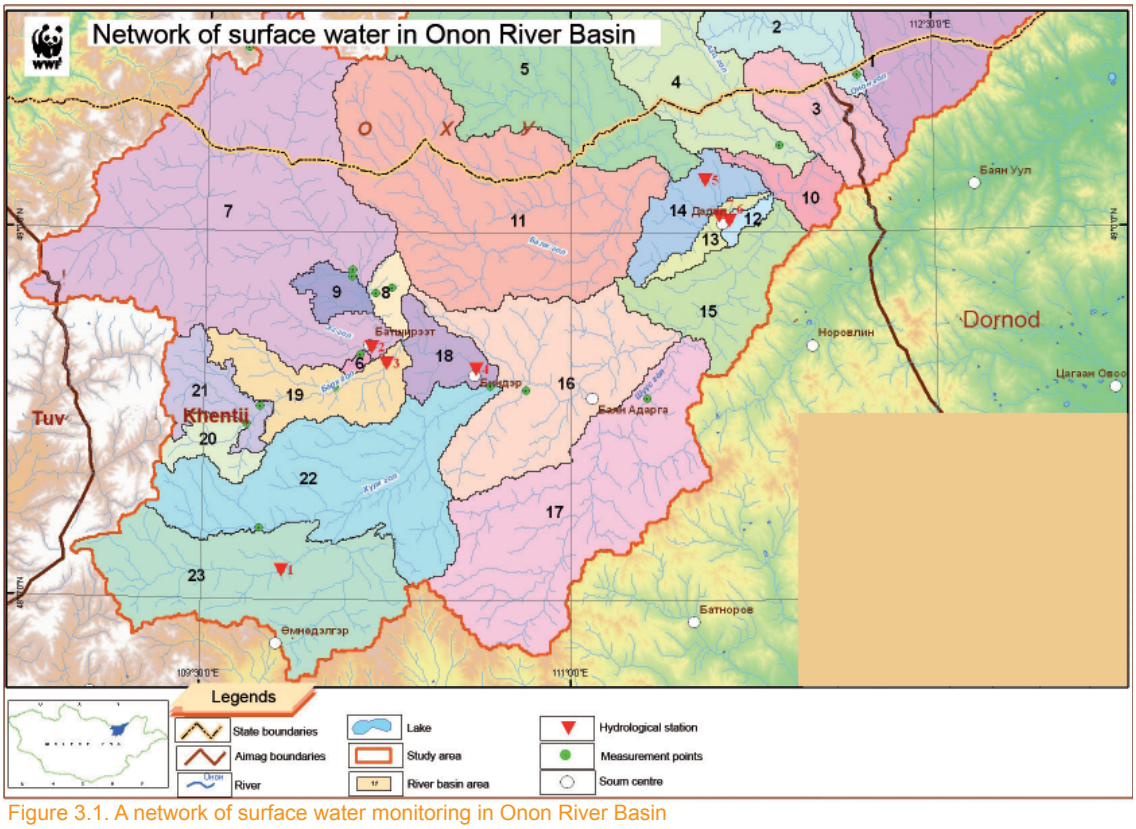


Figure 3.1. A network of surface water monitoring in Onon River Basin

In cold season, the 2.3-3.3 per cent of annual run-off is recorded and the percentage of run-off recorded in winter is increased in lower part of the river. In winter, Onon river is not completely frozen to its bottom. However, the small sized rivers e.g. Khurkh and Eg are entirely frozen to their bottoms.

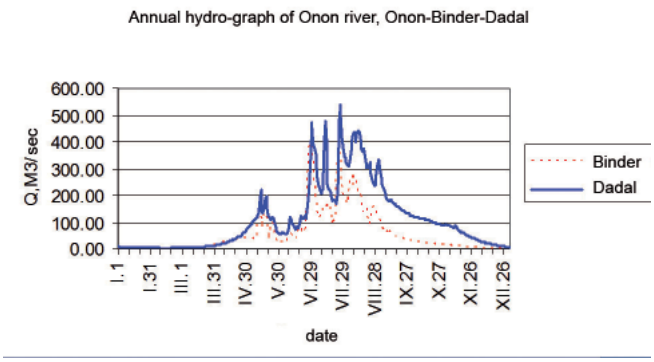


Figure 3.2. Annual run-off regime of Onon river

According to the long term average data, the 3.12 km^3 of run-off (through the State border) is delivered to Onon River Basin and the ecological run-off amount is 8-20% of long term average run-off and 13.0% in average along Onon river. In other words, it means the water consumption per annum should not exceed 0.40 km^3 in Onon River Basin.

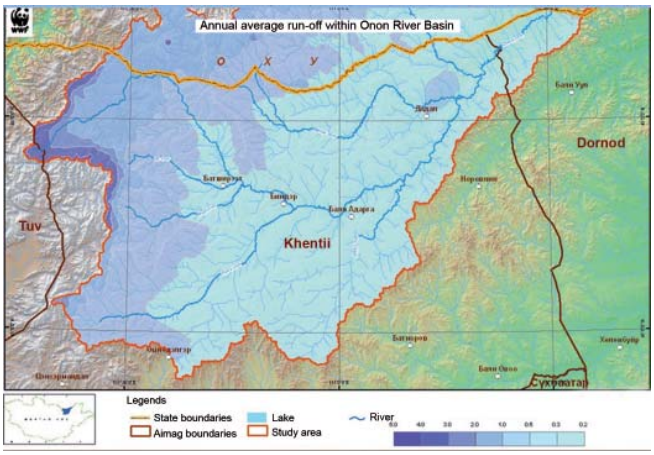


Figure 3.3. Territorial distribution of annual average run-off within Onon River Basin (l/sec km^2)

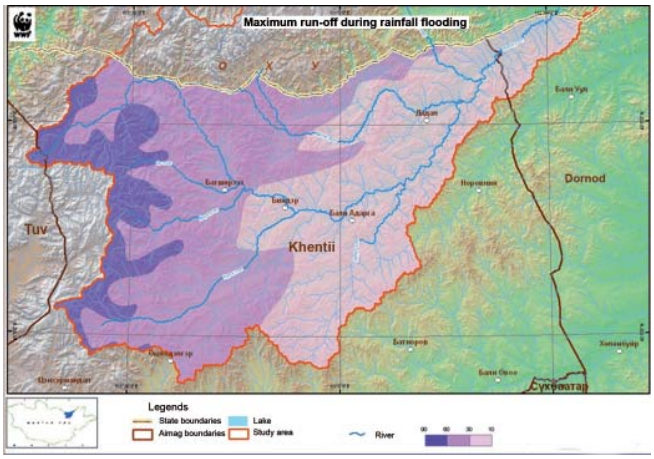


Figure 3.4. Territorial distribution of rainfall flooding water with 1 per cent rate in Onon River Basin (l/sec)

Annually, 320 mm of rainfall occur in Onon River Basin and 58-94 mm of this total amount constitutes surface water run-off and the rest or 226-260 mm feed ground water resource and evaporates. In other words, 18-30 per cent of annual rainfall constitutes river run-off in the Basin. According to the statistic hypothetical/conformity model, amounts of water flow from melting snow and ice that occurs once in a hundred year include 730-850 m^3/sec of water flow from melting snow and ice and 1360-2220 m^3/sec of rainfall in Onon River Basin.

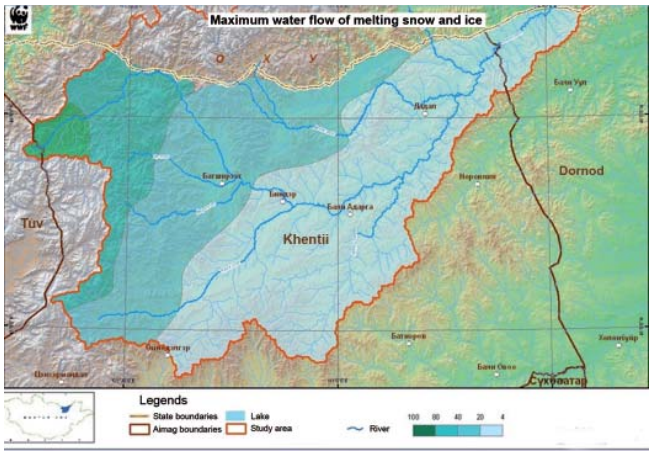


Figure 3.5. Territorial distribution of water flow of melting snow and ice with 1 per cent supply in Onon River Basin (l/sec km^2)

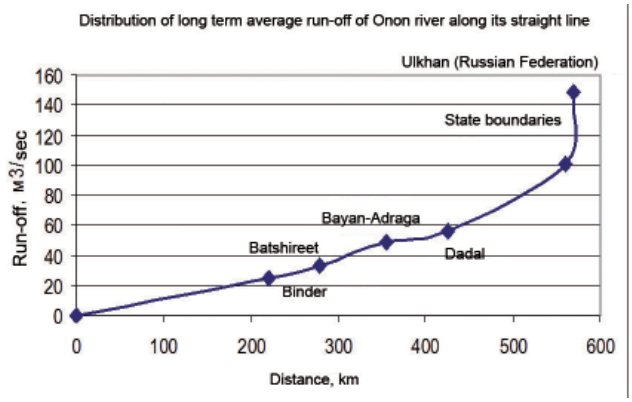


Figure 3.6. Distribution of long term average run-off of Onon River along its straight line

The peak of cold season lasts for 160-170 days in big rivers and for 190-200 days in small rivers. Onon-Binder hydrological observation guard records the peak period of cold season is 0.14 m^3/sec in wintertime.

Water pollution transferred through Khumul river in Russia was recorded in Onon river and it is likely to continue in the future. Thus, it needs to expand the current monitoring and observation network upon the consideration of water regimes, resource, quality, space and time, to improve monitoring and measuring equipment and tools, to ensure adequate (quality) data and information on continued basis, and to make more clarifications and details on trans-boundry water issues in agreements and treaties with Russia.

FOUR. STUDIES ON GROUND WATER

In terms of geographical feature, main water catchment areas in the Basin include river valleys, tributaries, deltas in vicinities of lower parts of rivers, and extensive depressed areas in river valleys. Namely, they include Arangat valley to the north west of Batshireet soum, deltas of Onon and Khurkh rivers, Khurkhree lake, depressed valleys in surrounding areas of Great and Small White lakes, and deltas and valleys of Balj, Galttai, and Tengeleg rivers. Absolute height of depressions, valleys, plains, and channels is 850-1200 m or generally in downward position.

Permafrost existing on long term run is unevenly found in some tops and slopes of Great Khentii mountain range, where an origin of Onon river exists, but it is rarely and unevenly found in small areas along watersheds of the rivers e.g. Barkh, Khurkh, and Shuus, mountain slopes, and in some parts of Onon river watershed.

Figure 4.1 and Table 4.1 show how many per cents of total rainfall occurred in Onon River Basin are penetrated into nutritive topsoils and bottom soils and rocks. According to the Figure and Table, the annual precipitation is 300-400 mm, 3-7 per cent of which is penetrated into the valleys covered by Onon river alluvial sediment and more than 50 per cent of this total precipitation amount are penetrated into some separated and extensive valleys. The 10-20 per cent of the precipitation in the upper and middle valleys of Onon river, where 400-500 mm of precipitation occurs, and the 10-20 per cent of precipitation in the vicinity of Onon river upper side, where more than 500 mm of precipitation occurs, are penetrated into the basic rocks that are covered by loose sediments distributed over the mountains and their ranges in the vicinity of Onon river upper side.

Estimation of ground water resource per one sq.km by using the findings of map on Onon River Basin ground water resources as follows: 1) adequate resource that is more than 16.5 l/sec or the average; 2) intermediate resource that is between 1-3 l/s; 3) resource below intermediate that is between 0.1- 1.0 l/s; 4) low resource that is between 0.03-0.1 l/s; and 5) extremely low resource that is below 0.03 l/s, Onon River Basin supports totally 551.17 million m^3 of ground water and belongs to the region that has low ground water resource. This amount of ground water is only sufficient to supply the water needs in the nearest years.

Therefore, it needs to intensify research, monitoring, and assessments e.g. strategic environmental assessment throughout Onon River Basin, mapping on ongoing water changes and evolution of Gurvan lake that is dominantly fed by ground water, and catching of surface water for feeding ground water, where necessary.

Table 4.1. Penetration rates of precipitation

Ground water run-off (mm/ year)	Precipitation (mm/year)			Average penetration rate
	500, дээш	400-500	300-400	
	Penetration rate	Penetration rate	Penetration rate	
5-10	-	-	1-3	2
10-20	-	3-7	-	5
20-50	-	5-13	-	9
50-100	10-20	-	-	15
>100	-	>50	>50	50

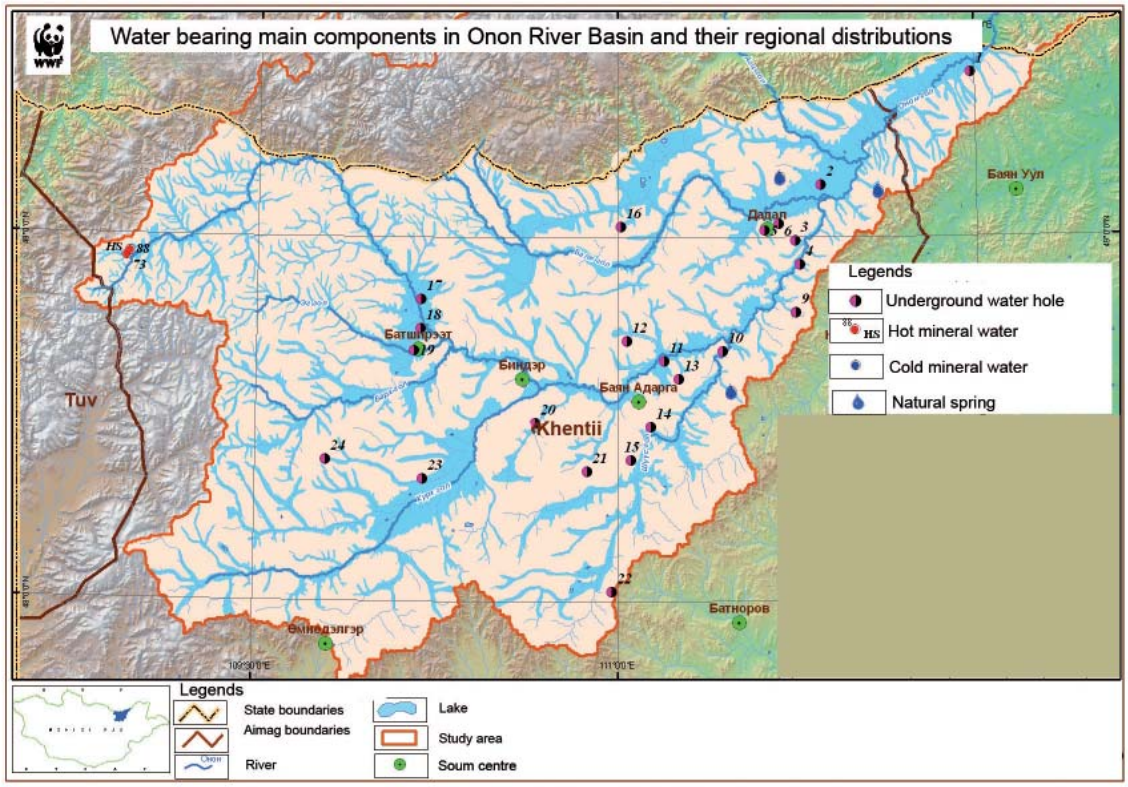


Figure 4.1. Water bearing main components/ compositions in Onon River Basin and their regional distributions

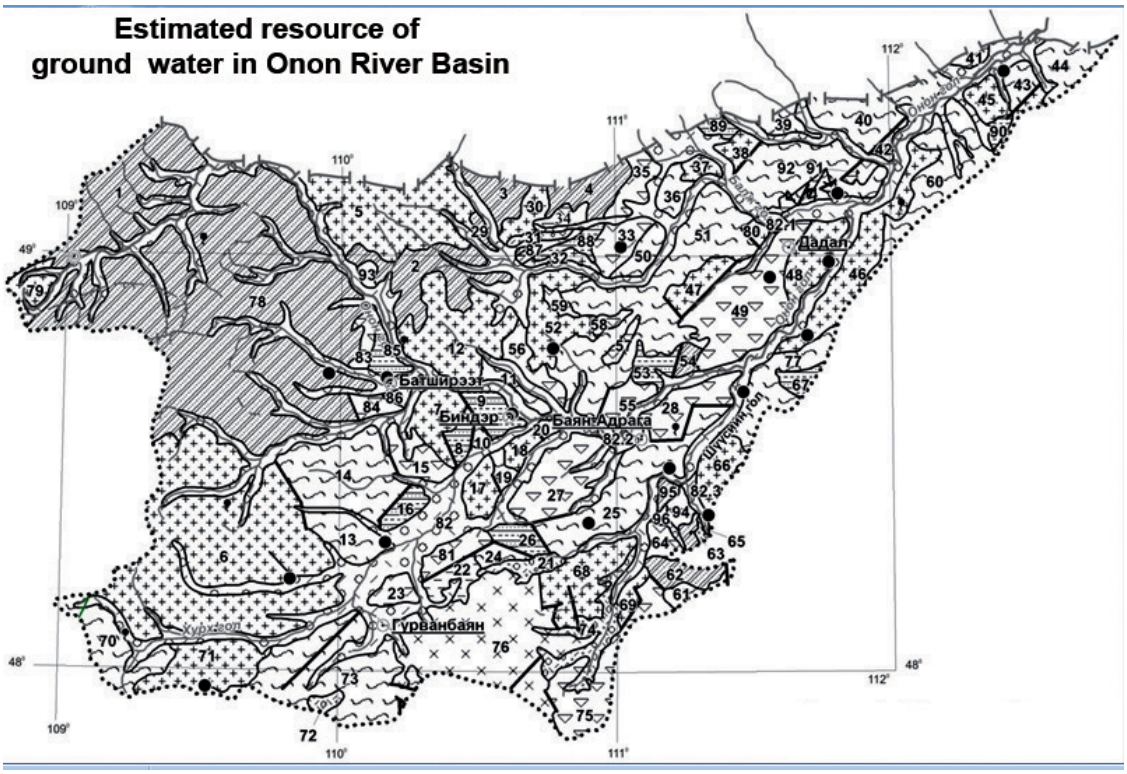


Figure 4.2. Approximately estimated resource of ground water for water consumption in Onon River Basin

FIVE. STUDIES ON WATER QUALITY

Onon river is regarded as one of the big rivers that support fresh, soft, and clean water in their untouched or natural conditions, are free of human activity impacts, and have extremely low rate of mineralization like fresh watered rivers in Khangai region in the country.

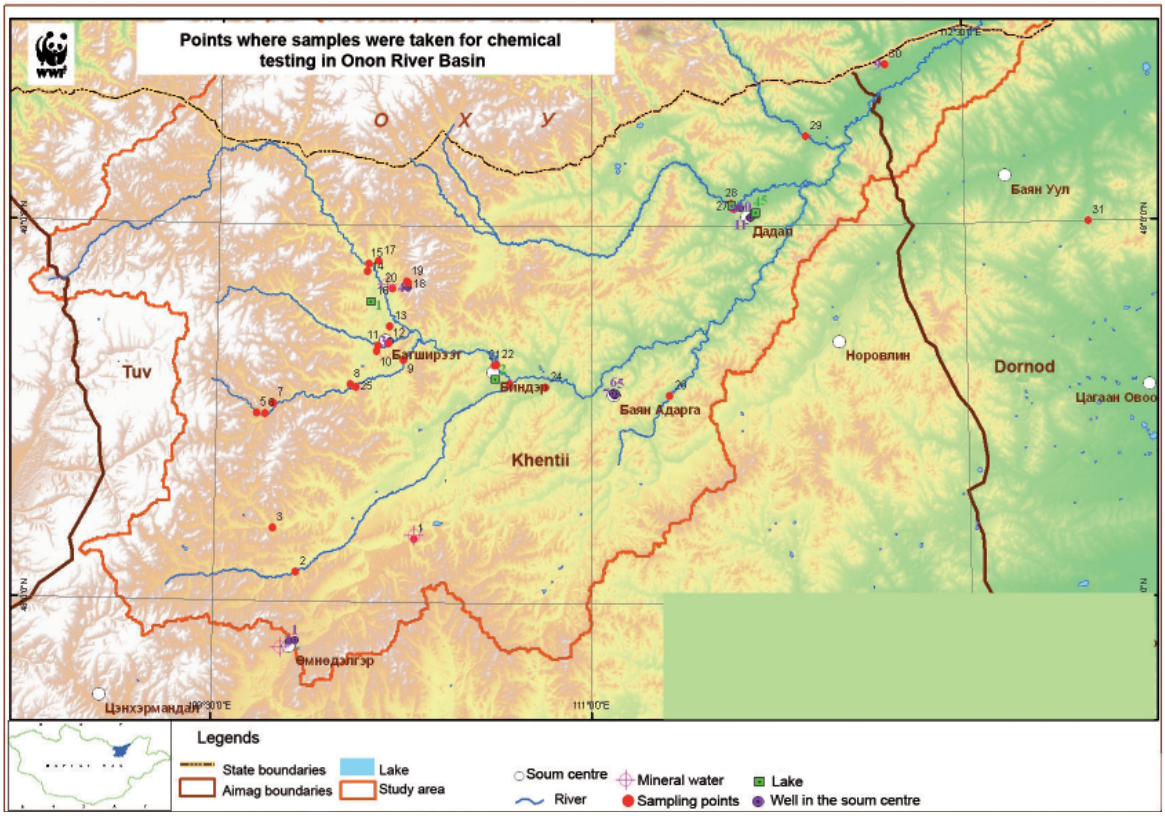


Figure 5.1. Locations, where samples were taken for chemicals testing in Onon River Basin.

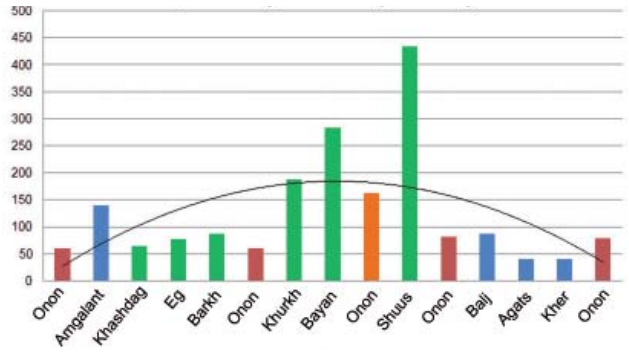


Figure 5.2 . Mineralazation in rivers inflowing into Onon river (mg/l)

Notes: red – Onon river; blue-inflowing rivers to the east; and green – inflowing rivers to the west.

According to the figure, the inflowing rivers on right hand has more mineralization and the inflowing rivers on left hand have less mineralization. However, as the big rivers e.g. Agats and Kher inflow into Onon river, its mineralization rate is likely to reduce. Generally, the rivers originated from highland have less mineralization, while the rivers of steppe nature have relatively higher mineralization. In addition to less mineralization, the rivers have very soft water and low contents of such micro elements e.g. fluorine and maganese. However, when the rivers are flooded with water flows of melting snow and ice, the rivers' water is turned into yellow and has higher permaganous oxidation.

Since the heads of livestock to be grazed nearby natural springs, rivers, streams, and other open water bodies already exceed the pastureland ecological carrying capacity and large herds of livestock stand in open water bodies for being cooled in summertime, the water bodies have been polluted with livestock wastes and have lost their natural purification capacity. These findings were proved by the samples, where ammonia was discovered.

Rivers of Onon River Basin, a home to historical and cultural sites, have fresh and soft water that is dominant with hydro-carbonate calcium in their compositions like the rivers in Khangai region. In addition to this, the rivers are in their untouched natural conditions because they are less affected by negative impacts of human activities. Since animal husbandry and farming or cultivation is largely engaged in the valleys of inflowing rivers e.g. Khurkh, Bayan, and Shuus of steppe nature that have gentle currents, the rivers are threatened with pollution in the future.

Throughout the Basin, there are a number of mineral water bodies and fresh and salty lakes containing hot and cold water and carbonates/carbonic acid gas. There was a number of mineral water bodies recorded in territory of Umnudelger soum. However, some of them were already dried up and lost their mineral water qualities. Thus, it needs to take appropriate measures to restore and protect the mineral water bodies and preserve their mineral water qualities. Furthermore, these mineral water bodies will be an ideal tool for tourism development in the Basin.

The soums located in Onon River Basin have adequate fresh and soft water sources/ discharges of ground water. However, the water qualities of a well used by Binder soum hospital and wells to the north and west of Umnudelger soum center are low or do not meet the requirements. The well in the west of Umnudelger soum center was installed a device to soften the well water and well maintained and the soum center residents are supplied with water from the well. It needs to take appropriate measures to maintain surrounding areas and establish sanitation zones around the wells, where household drinking water is supplied.

In developed countries, the water ecology is completely changed in the vicinities of big cities as the rivers running along the big cities are usually straightened and fenced on their sides. Thus, foreign tourists and visitors come to see or enjoy untouched scenery including the rivers running in their natural conditions, the foreign researchers and explorers come to study the natural and untouched conditions including the rivers and lakes. Rivers in Onon River Basin are not affected by technogenic impacts. Thus, it needs to preserve the untouched conditions of rivers in the future.

SIX. CURRENT STATUS AND FUTURE TENDENCY OF WATER CONSUMPTION

Current status of water consumption in Onon River Basin was studied in relation to human population, animal husbandry, industries, mining, and tourism development aspects.

Human population water supply: in the region, the drilled wells, wells dug in pastureland, manual wells, Onon river and its inflowing rivers, streams, and natural springs provide for main sources of drinking water for human population. In soum centers and settled areas, their residents use water from 2-4 drilled wells. Some residents of Batshireet and Binder soums carry and use drinking water from Eg and Onon rivers in summers and winters.

During the studies, actual daily water consumption per an individual of herder household was limited to 7-9 litres. Compared to the daily water consumption per an individual, who lives in an apartment that is connected to a centralized water supply facility in Darkhan, Erdenet, and Choibalsan towns, to the daily water consumption per an individual, who lives in the same apartment (but it has no hot water) in an aimag center, and to the daily water consumption per an individual, who lives in the soum center, this inadequate water consumption is lower by 20 times, 10 times, and 2-3 times less respectively.

The water consumption by human population was identified based on temporary norms approved by the Nature and Environment Minister's Order No: 153 in 1995.

Table 6.1. Annual water consumption by residents of Onon River Basin, 2010

No	Soums	Residents of rural areas	Water consumption per capita (l)	Daily consumption (l)	Soum center residents	Daily consumption per capita (l)	Daily consumption (l)	Total daily consumption (m3)	Annual consumption (m3)
1	Umnudelger	3619	15	54285	1551	25	38775	93.1	33981.5
2	Batshireet	1439	15	21585	617	25	15425	37	13505
3	Binder	2294	15	34410	1530	25	38250	72.6	26499
4	Bayan-adraga	1633	15	24495	690	25	17250	41.7	15220.5
5	Dadal	1729	15	25935	931	25	23275	49.2	17958
6	Norovlin	280	15	4200		25	0	4.2	1533
7	Bayan-uul	120	15	1800		25	0	1.8	657
	Total	11114		166710	5319		132975	299.6	109354

According to the current human settlement and movement rates, the average growth of human population in the Basin is expected as 0,9-1,8 per cent and 16,590 inhabitants up to 2015 and 2,2 per cent and 18,186 individuals starting from 2021 (Socio-economic studies).

Table 6.2.Future tendency of human population water consumption

Year	Number of people	Water consumption in a year per person (m^3)	Total consumption (m^3)
2015	16590	9.1	150969
2021	18186	9.1	165492.6

Water supply of animal husbandry: according to the nationwide inventory on wells, natural springs, lakes, and rivers (2007), there were totally 79 drilled wells (but 51.6 % of them were broken down and their parts were stolen) and 440 short piped wells (but 64.1% of them were broken down and their parts were stolen) that were built with the State and project/ programme funding recorded in the Basin.

Due to the increasing dryness in the region in recent years, the 61.3% of natural springs were dried up, the 46.9% of rivers had no run-off, and the 24.5% of rivers face lack of water and cut in some parts. Consequently, these actual conditions impact on big rivers' run-off.

Based on the national statistics on livestock in Khentii aimag (2009) and norms of water consumption by dominant stocks in established average ages of livestock individuals (Nature and Environment Minister Order No: 153), the annual water consumption per a head of livestock was estimated and then it was considered for all the heads of livestock to be resided the Basin.

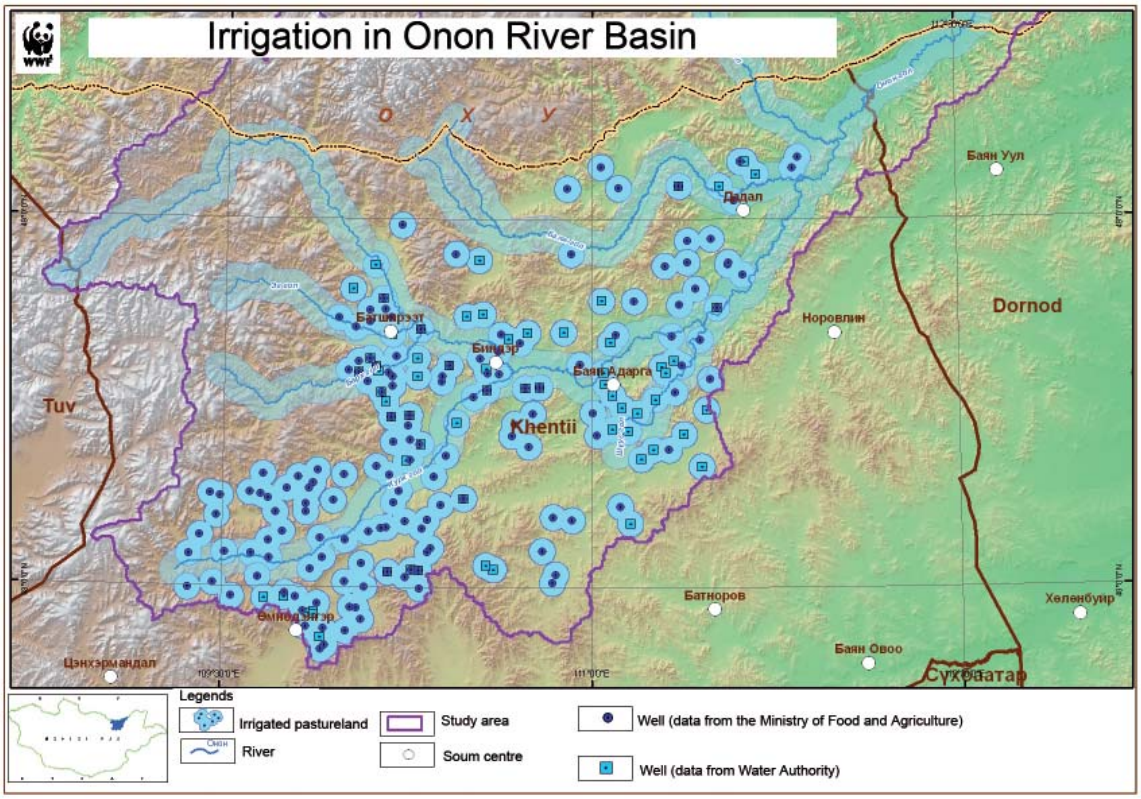


Figure 6.1. Irrigation in Onon River Basin

Table 6.3. Livestock water consumption in Onon River Basin, 2009

No:	Soums	Number of live-stock	Total consumption, (m3)
1	Umnudelger	165131	211148
2	Batshireet	52864	165803
3	Binder	123541	318284
4	Bayan-adraga	82015	179344
5	Dadal	27294	112197
6	Norovlin	8204	20021
7	Bayan-uul	2074	7044
	Total:	461123	1013841

In compared the heads of livestock of the soums (included in the Basin; in their administrative unit borders) in 2009 to that in 2005, the heads of livestock in four kinds except for camel were increased by 9.3-74.3% and the annual average growth rates in each kind of livestock were increased by 1.9-19.1. However, heads of camel were reduced by 29,6%. Based on the annual growth rates of livestock populations, the heads of livestock and their water consumption rates expected in 2015 and 2021 are estimated as follows (Table 6.4):

Table 6.4. Water consumption by livestock populations in 2015 and 2021 (m^3)

	camel	horse	Cattle	sheep	goat	total
Heads of livestock	351	30743	70848	198778	160403	461123
Growth rate		9.7	44	84.4	95.6	
Heads of livestock expected in 2015	350	33725	102021	366546	314389	817030
Annual water consumption by livestock	17.6	7.5	7.3	1	1	
Total consumption	6160	252938	744753	366546	314389	1684786
Heads of livestock expected in 2021	400	36996	146910	674444	614944	1473694
Total consumption	7040	277470	1072443	674444	614944	2646341

Irrigated farmland or cultivation: In Onon River Basin, the soums Umnudelger, Binder, and Bayan-adraga (their farmland or cultivated areas lie in Ulz River Basin) run crop cultivation and farming. Umnudelger soum supplies about 80 per cent of crops needed for Khentii aimag. Wheat is planted totally in 19,007 ha including 17,802 ha cultivated by 11 business entities and 1,205 ha cultivated by 11 individuals in Khurkh bag.

Farmers, who plant vegetables in irrigated areas, usually plow land and plant vegetables including potato in river floodplains. They use the pumps that operate with generators for watering their plots. Because of fuel consumption, they do not follow up the irrigation or watering norms and regimes. At present, the farmers water their plots using a simple method of irrigation drawing water through their individual dams and channels from Bayangol River in Binder soum, Shuus river and Khankhar natural spring in Bayan-adraga soum, and Buur natural spring in Dadal soum.

Table 6.5. Water consumption in irrigated farmland (m^3) 2009

№	Soums	Areas (ha)	Planted	Irrigation norm (m^3/ha)	Water amount (m^3)
1	Umnudelger	82.5	Vegetables including potato	3000	247500
2	Batshireet	10	Vegetables including potato	3000	30000
3	Binder	6	Vegetables including potato	3000	18000
4	Bayan-adraga	12	Vegetables including potato	3000	36000
5	Norovlin	0		3000	0
6	Dadal	7.5		3000	22500
7	Bayan-uul	1.5	Vegetables	3000	4500
	Total:	119.5			358.500

Throughout the Basin, totally 20,000 ha was abandoned. In addition to this, farming or cultivation business in Batshireet and Dadal soums have almost ceased.

As a result of a number of studies and surveys on development of irrigated farmland in Onon River Basin in the past, it was identified that totally 5.5 thousand hectare area may be used for farming or cultivation in terms of water accessibility and soil characteristics (Figure 6.2). According to the socio-economic survey findings, it recommends growing silage and fodder plants required needed for intensive animal husbandry in irrigated farmland.

Table 6.6. Future development tendency of irrigated farmland

Years	Areas /ha/	Planting	Irrigation norm (m3/ha)	Water amount (m3)
2015	120	Vegetables	3000	360000
2021	200	Vegetables	3000	360000
	1000	Feeding stuff	2800	2800000
Дүн	1200			3760000

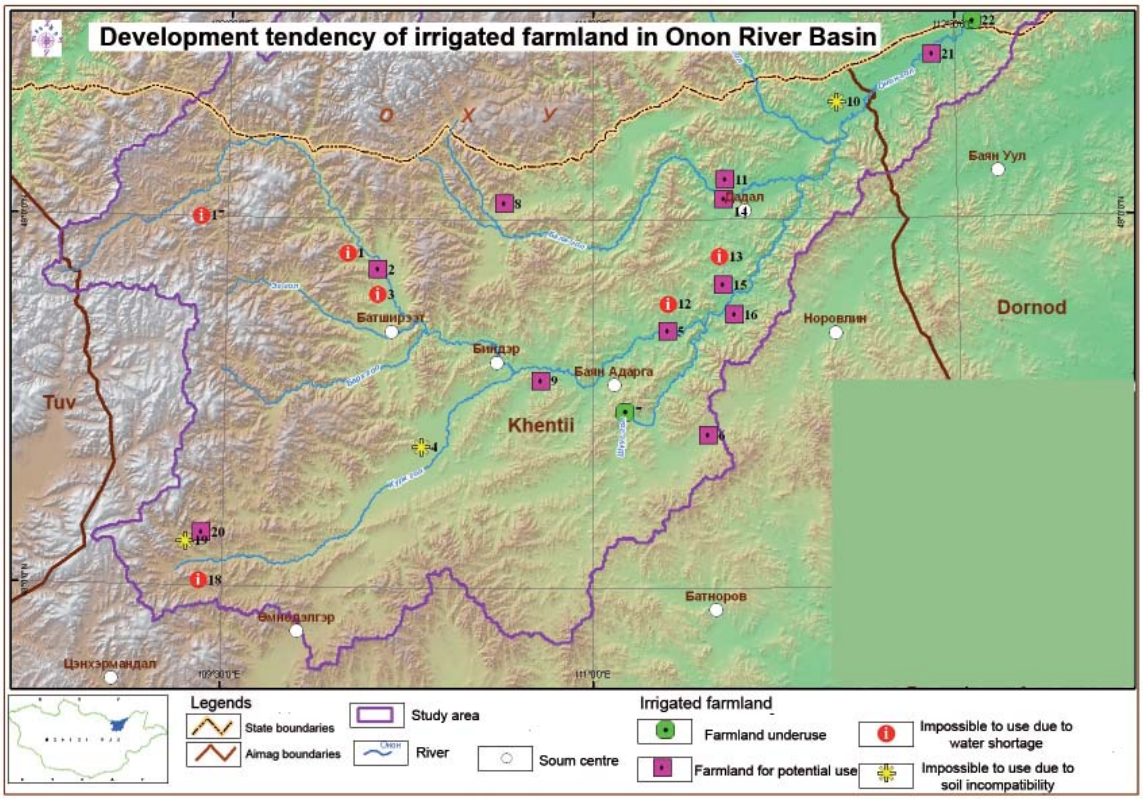


Figure 6.2. Locations of areas that are ideal for irrigated farmland in Onon River Basin

Water consumption in mining industry: "Altai Khangain Burged" LLC has been exploiting gold in Saikhan River Basin (48.29.48,4 109.41.35,9 H=1264) in territory of Umnudelger soum of Khentii aimag since July, 2009.

In order to make Onon River Basin an exemplary eco-region in Mongolia, the mining operations should be prohibited. Thus, no any water consumption estimations are considered in the mining industry within the Basin.

Table 6.7. Annual water consumption in the mining industry (m^3)

No:	Soums	Area name	Materials to be annually washed (m^3)	Water norm (m^3)	Consumption (m^3)	Of which: in rotation 30%	In turnover 70%
1	Umnudelger	Saikhan	128000	4.1	524800	177400	347400
2	Batshireet	Gutai	34600	4.1	141860	42500	99300
Total			162600		666660	219900	446700

Tourism: Totally 18 special permissions to run tourism business were issued to some local individuals and business entitites in Onon River Basin, however only over ten license holders run their operations.

Tour camps are run on seasonal basis, but they are not able to attract tourists and visitors due to their poor infrastructure including accommodations and limited types of services.

Table 6.8. Annual water consumption by tour camps (m^3)

Years	Capacities of tour camps (day/man)	Daily water consumption (m^3)	Days in operation	Total consumption (m^3)
2009	790	0.045	120	4266
2015	1000	0.045	120	5400
2021	1500	0.045	120	8100

Table 6.9. Other types of water consumption

Years	Public bath house (m^3)	Livestock washing points (m^3)	Resort (m^3)	Public dining places (m^3)	Total (m^3)
2009	1125	359	5250	2496	9230
2015	1312.5	681	6300	3168	11461.5
2021	1875	1289	7350	4200	14714

SEVEN.CONSOLIDATED WATER BALANCE

The balance of water business entity of Onon River Basin was estimated by I. Baldangombo, Engineer of Water Research and Development Institute; the ground water resource was estimated by N. Jadamba, (Sc.D) & Researcher of ground water, Integrated Water Resource Management Project; the surface water resource was estimated by D. Ouynbaatar, (Ph.D) Hydrologist and Engineer, Institute of Hydrology, Meteorology and Environmental Observation, and D. Saikhanjargal, Engineer of Water Research and Development Institute.

Basin water resource. Annual average run-off of Onon river is 3.11 км^2 (through the State border) and usable water resource for consumption is 13 per cent of total run-off or not more than 0.4 км^2.

Future changes in water resource within Onon River Basin were basically identified by G. Davaa. According to the research findings on changes in run-offs of big rivers and three basins in Mongolia, the Onon river run-off is expected to be slightly increased in next 10-40 years, but the dryness would be a concern due to increasing water evaporation rate throughout the Basin.

Estimated ground water resource for consumption in Onon River Basin is 551.2 million. m^3/year. This estimation was made within water bearing sediment and rock boundaries or 30058.8 km^2 area. In 29070 km^2, where the water balance is estimated, the water resource is 531 million.m^3/year.

Table 7.2. Distribution of estimated ground water resource in Onon River Basin

Routes/Points	Water catchment area (km^2)	Usable water resource	
		m^3/s	km^3/year
Onon-Binder	8810	5.1	0.161
Onon-Bayan-adraga	17792	10.3	0.325
Onon-Dadal	25060	14.52	0.458
Onon-State border	29070	16.84	0.531

Water evaporation and loss within the Basin

For estimation of water evaporation in Onon River Basin, the data collected by Onon-Binder and Onon-Dadal hydrological observation guards and the data collected by Binder and Dadal meteorological stations were used.

Table 7.3. Evaporation of surface water along Onon river (мм)

River-Guard	Evaporation (ET) /mm/
Onon-Binder	226.0
Onon-Dadal	261.0

Table 7.1. Onon River Basin Rivers' Run-off (thousand.m^3)

Д/д	Routes/Points	Water catchment area (km^2)	Long term average run-off (m^3/sec)		Usable water resource for consumption	
			m^3/sec	km^3	m^3/sec	km^3
1	Jargalant	1144.8	2.88	0.08893	0.374	0.01156
2	Saikhan	272	0.18	0.00556	0.023	0.00072
3	Khujirt	313.5	0.31	0.00556	0.040	0.00124
4	Barkh Deed	275	0.19	0.00587	0.025	0.00076
5	Bayangol	293.4	0.25	0.00772	0.033	0.00100
6	Tsegeen Khooloi	179	0.16	0.00494	0.021	0.00064
7	Khurkh-Khentii	1520	1.50	0.04632	0.195	0.00602
8	Khurkh Adag	5861	12.00	0.37055	1.560	0.04817
9	Eg-Batshireet	987	2.76	0.08523	0.359	0.01108
10	Barkh-Batshireet	1871	5.16	0.15934	0.671	0.02071
11	Barkh-Adag	2004	5.59	0.17261	0.727	0.02244
12	Onon-Batshireet	5678	25.40	0.78433	3.302	0.10196
13	Gutai	49.7	0.09	0.00278	0.012	0.00036
14	Amgalant	139.3	0.12	0.00371	0.016	0.00048
15	Onon-Binder	8810	32.90	1.01592	4.277	0.13207
16	Onon-Bayanadraga	17792	48.50	1.49763	6.305	0.19469
17	Bayangol	525	0.85	0.02625	0.111	0.00341
18	Shuus	3580	7.80	0.24086	1.014	0.03131
19	Onon-Dadal	25060	56.40	1.74158	7.332	0.22640
20	Balj-Dadal	3698	12.60	0.38908	1.638	0.05058
21	Agats Adag	2226	6.23	0.19238	0.810	0.02501
22	Kher-Border unit	6000	25.80	0.79668	3.354	0.10357
23	Onon-State border	29070	101.03	3.11971	13.134	0.40556

Water consumption of Onon River Basin

Total resource of surface water in Onon River Basin is 3186.1 million m³/year. Potential usable water resource from rivers is 414.194 million m³/year or 13 per cent of total run-off in the Basin. This is the usable amount of water from rivers for annual consumption.

As of 2009, the 0.38 per cent of estimated water from rivers for consumption was used for animal husbandry, mining, and cultivation operations. It is expected to be 0.55 per cent in 2015 and 1.31 per cent in 2021. According to these estimations, there is adequate water resource in the Basin.

0.75 per cent of ground water resource was used for human population, tourism, and other consumption in 2009. This consumption is expected as 1.02 per cent in 2015 and 1.28 per cent in 2021. According to these estimations, there is adequate water resource in the Basin.

In 2009, total water consumption in Onon River Basin was 1.73 million m³ that was only 0.046 per cent of total water resource in the Basin. It shows that there is a good opportunity to develop and implement optimal management option for water consumption in the Basin.

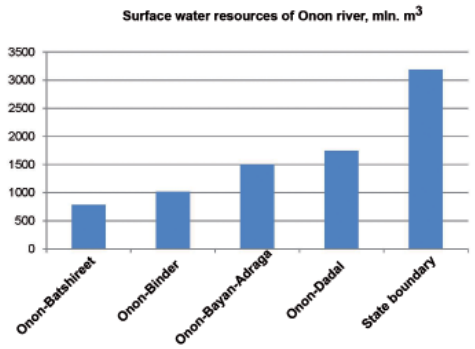


Figure 7.1. Water resources use status in Onon River Basin, 2009

Table 7.4. Current status of surface water resources use, its future trends

Animal husbandry			Mining			Agriculture		
2009	2015	2021	2009	2015	2021	2009	2015	2021
0.245	0.407	0.639	0.053	0.0	0.0	0.087	0.145	0.676

Table 7.5. Current status of underground water resources use, its future trends

Human population			Tourism			Others		
2009	2015	2021	2009	2015	2021	2009	2015	2021
0.603	0.832	0.912	0.024	0.030	0.045	0.127	0.159	0.319

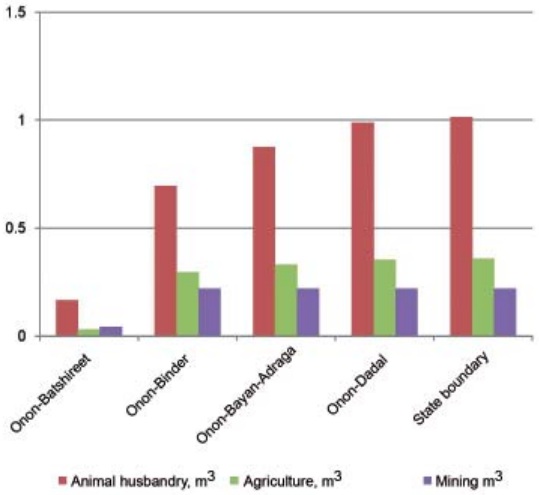


Figure 7.2. Water consumption status in Onon River Basin (2009)

Majority of water consumption is found in animal husbandry. Details on water consumption are given in Figure 7.3 below.

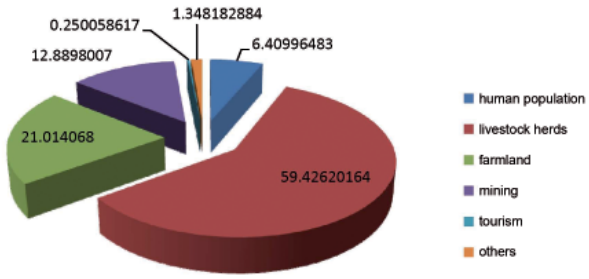


Figure 7.3. Water consumption status in Onon River Basin, 2009

Future tendency of water consumption in the Basin

Based on the water consumption rates by human population, livestock herds, irrigated farmland, mining and industries in 2009, the water consumption tendency in 2015 and 2021 was projected in each administrative unit throughout the Basin.

Water consumption in Onon River Basin was 1.73 million m³ in 2009. It is expected to be 2.47 million m³ in 2015 and 5.68 million m³ in 2021 to the projection.

Since there is a potentiality of development of intensive farm business in the region, the highest rate of water consumption by livestock will be continued in the future. When 1.014 million m³ water was used in 2009, it is expected 0.151 million m³ and 2.646

Table 7.6. Water consumption in Onon River Basin /in width/ (million. м3)

		Human population	Animal husbandry	Farming / cultivation	Mining	Tourism	Others	Total
1	Onon-Batshireet	0.014	0.166	0.030	0.043	0.001	-	0.253
2	Onon-Binder	0.074	0.695	0.296	0.220	0.003	-	1.287
3	Onon-Bayanadraga	0.089	0.875	0.332	0.220	0.003	-	1.518
4	Onon-Dadal	0.107	0.987	0.354	0.220	0.004	-	1.672
5	State border	0.109	1.014	0.359	0.220	0.004	0.023	1.73

million m³ in 2015 and 2021 respectively according to the projection.

In irrigated farmland, vegetables including potato were planted in 119.5 ha and 0.359 million m³ was used for it in 2009. As the fodder plants needed for intensified farm business are planted in 1,000 ha, it is expected to use 3400000 м³ of water by 2021.

Since rivers in Onon River Basin are still in their natural formations, not affected by technogenic impacts, it needs to preserve their untouched conditions in the future. In order to preserve the natural untouched conditions and ensure natural and ecological balance and sustainability, it is inevitably necessary to restrict mining operations in the Basin. Thus, no water consumption by mining industry in the Basin is projected for 2015 and 2021.

Although the use of mineral resources is economically beneficial, it destroys natural conditions and negatively impacts on the River Basin ecosystem. Thus, it needs to restrict mining operations in the Basin. One of optimal use of the river ecocystem on sustainable and efficient ways is the development of eco-tourism. Therefore, the water consumption in this field would be increased as follows: 0.005 million m³ in 2015 and 0.008 million m³ in 2021 according to the projection.

As tourism is developed in the Basin, the water consumption rates e.g. in public bathhouses, resorts, and tour camps will be increased. When totally 0.023 million m³ was consumed in 2009, the water consumption is expected as 0.029 million m³ and 5.68 million m³ in 2015 and 2021 respectively.

Table 7.7 Current status and future tendency of water consumption in Onon River Basin (million м³)

Years	Inhabit-ants	Animal husbandry	Farming & cultivation	Mining	Tourism	Others	Total
2009	0.109	1.014	0.359	0.220	0.004	0.023	1.73
2015	0.151	1.685	0.247	0	0.005	0.029	2.47
2021	0.165	2.646	3.400	0	0.008	0.058	5.68

Balance by water business entity

Water resource of Onon River Basin is 3737.25 million m³ including 3186.1 million m³/year surface water resource in horizontal way across Onon-State border. As of 2009, only 1.73 million м³ or 0.046 per cent of total water resource of Basin was consumed. It shows a potentiality to use optimal water management in water consumption in the Basin.

It was projected the water consumption as 1.73 million м³ in 2009, 2.47 million м³ in 2015, and 5.68 million м³ in 2021. These projections constituted 0.046 per cent of total water resource in the Basin in 2009, 0.066 per cent in 2015, and 0.152 per cent in 2021.

It regards that there are no impacts on ecological balance when usable water resource from the Basin is 965.36 million м³ or 13 per cent of surface water resource. According to our estimation, only 0.18 per cent of usable water resource in the Basin was consumed in 2009 and it is expected 0.26 and 0.59 per cent in 2015 and 2021 respectively.

Since rivers in Onon River Basin are still in their natural formations, not affected by technogenic impacts, it needs to preserve their untouched conditions in the future. In order to preserve the natural untouched conditions and ensure natural and ecological balance and sustainability, it is inevitably necessary to restrict mining operations in the Basin. Thus, it is projected that there is no water consumption by in mining industry in the Basin in 2015 and 2021.

According to the consolidated balance of water business entity, the water access and consumption for animal husbandry is sufficient enough, but overgrazing and lack of eatable plants and fodders for either domestic or wild species due to reduced water points in pastureland. These warnings and concerns are also highlighted in conclusions of ecological, social, and economic surveys. Thus, it needs to pursue the policy to restrict the heads of livestock within the established amounts as planned in 2015.

EIGHT. STUDIES ON FOREST STATE

According to the botanic-geographical province, the forested areas of Onon River Basin belong to the easetern part of Mongol-Dahurian region and according to the forest-vegetation provicnce in Mongolia, they lie in Balj and Ereen mountain range region of circle of Ereen pine, birch, and Dahurian boreal conferious forest, of Daurian forest-vegetation province of South Uvur Baikali forest-vegetation province and Tuul-Barkh circle of East Khentii forest-vegetation province.

The basin supports the eastern part of Siberian larch forest in Mongolia, the southern part of Daurian larch forest in the world, and the main part of Chekanovskii coniferious forest, sub-population of two species above, in Mongolia. While area #1 of Onon river is disbtributed by pine (*Pinus sibirica*) in quite large areas, the continued mountains of great Khentii mountain range are distributed by spruse (*Picea obovata*) in very limited areas. This area supports the easternmost edge of Siberian spruse in Mongolia. Moreover, the pine (*Pinus sylvestris*), a key species that provides for forests, is mainly distributed on Ereen mountain range. In addition to these species, the Kriloviin pine (*Pinus Krylovii*) is recorded within limited areas. Kriloviin pine, Dahurian larch, and Chekanovskii larch are the big deciduous species, which is regarded as rare species in Mongolia, and are distributed in the region. From these three species, the Dahurian larch is listed in the Mongolian Red Book.

Forest ecosystem, in terms of its ecological content, is widespread and dominant species include woody plants, bush, herborious plants, moss, and lichen. One of significant ecological importance of forests is to catch and evenly distribute water in their vicinities and to increase the precipitation amounts.

Depending on its climatic features, the forests and vegetation in Onon River Basin is specific in its formations. For instance, first region of Onon river is entirely covered by forests; continued reticulates are found along rivers and streams; the taiga/boreal coniferious forest zone is abundantly distributed by peatmoss and several species of green moss; forest soils have continued permafrost; and forest quality in sub-boreal coniferious forest zone is good.

In this region, there are sub-alpine woodland, boreal coniferious and sub-boreal coniferious forests found from four forest sub-zones recorded in Mongolia.

Onon River Basin lies in the eastern Khentii circle according to the forest fire threat province. In 1975-1999, totally 147 fires were recorded and 1840,0 thousand hectare of forest burnt in the circle. Forest fires are usually outbreak in April, May, June, and Septemer, but sometimes, steppe fires incurred in November. Regarding the damages, fires incurred only in Binder soum in 1998-2008 caused damages of MNT 76.6 million. Duration of fires was two to seven days. Because of fires, a process of replacing of larch forests by birch forests is underway. Among such birch stands, 40-60 aged birch is dominant. Tree heights are 13-14 m and diameters are 16-18 cm. Due to fires, the distribution of damageable pests is getting expanded in the deteriorated forests and particularly birch and larch forests are getting limited (Figure 8.1).

Figure 8.1. A willow stand along the river damaged by pests

Total forested areas in Onon River Basin is estimated as 1013974 hectare and 52.3%, of them are matured and old aged forests and only 3.5% of them is young forest. Thus, these statistics show forest management targeted at restoration of forests with young seedlings is particularly required.

According to the Basin forest taxonomic findings, the average bonitet is 4.0 and the average density is 0.51, which are quite below the national average meanings. It shows that the forests' quality is low. Moreover, the area covered by 1 ha of forest is 117,7 m^3 and forest growth rate of one ha is only 1 m^3. These are also inadequate indicators. Thus, it needs to prohibit industrial purposed tree cutting in the region, but forest cleaning purposed cutting should be managed in accordance with the established procedure.

Currently, a soum is issued with permission to cut 600-3000 m^3 trees for household needs within the national license and permission system. Trees or woods cut with permissions are usually used for building houses made of logs and producing sawn boards.

First of all, it needs to protect the taiga/boreal coniferious forests in zone 1 of Onon river, rare species and communities, and moss layers. Additionally, it needs to take preventive measures against the factors e.g. forest fires, outbreaks/distributions of damageable pests and diseases, and illegal and non-technological tree cutting that negatively impact on forest resources, and to carry out forest restoration. To appropriately tackle these problems and concerns, the community based organizations (CBOs) should be encouraged while putting forests and forest stands under the responsibilities of CBOs and allowing them to conduct forest cleaning and maintaining for improved their livelihoods.

NINE. STUDIES ON FISH AND LAMPREY

Onon River Basin belongs to the Amur province according to the fish zoogeographic classification and to Amur River Basin according to the worldwide fresh water watershed. Onon, Ulz, Kherlen, and Khalkh rivers are included in the basin. Among these rivers in the Basin, Onon river is the river inflowing in the basin. Rivers support different species of fish.

Rivers in upper part of Amur basin support fish species belonging to northern flat plain, northern mountain bottom, ancient tertiary, Chinese, and Artic compositions that were spread during historical evolution.

There are *Lampetra reissneri*, Amur sturgeons *(Acipenser schrencki)*, Flathead asp *(Pseudoaspius leptocephalus)*, Amur bitterling *(Rhodius sericeus)*, Carp *(Cyprinus heamatopterus)*, *Gobio soldatovi, Misgurnus angullicaudatus,* and *Parasilurus asotus* from ancient tertiary composition; the Amur ide *(Leuciscus waleckii), Phoxinus czekanowskii,* Lagowski or Chinese minnow *(Ph. Lagowskii), Ph. Percnurus, Gobio gobio,* Golden carp *(Carassius auratus gibelio), Cobites taenea, Esox reicherti* from norther flat plain composition; the Taimem *(Hucho taimen), Brachymystax lenok,* Amur pike *(Thymallus grubei),* Common minnow *(Phoxinus phoxinus), Nemachilus barbatulus,* Amur sculpin *(Cottus czanaga),* Haitej sculpin *(Mesocottus haitej)* from northern mountain bottom composition; and Khadary whitefish *(Coregonus chadary),* fresh water cod *(Lota lota),* from the Chinese flat plain: Stone moroco *(Pseudorasbora parva), Shilogobio soldatovi, Ladislavia taczanowskii,* and Amur barbel *(Hemibarbus labeo)* from the Artic fresh water species recorded in the basin (Dashdorj, 1976).

In Onon River Basin, the Japanese lamprey *(Lampetra japonica)* listed in the Mongolian Red Book, and the *Acipenser schrencki,* Brant, 1869 *of Acipenseridae,* the *Salmonidae Hucho taimen* Pallas, 1773*, Taimen, Cottidae Mesocottus haitej,* Dybowski from Salmonidae are recorded.

There are four tour camps along Onon river. Additionally, there are some fishing camps: a fishing camp of Balj and Onon delta or Balj Duruu near Degen Jigen canyon in Agaz-Onon delta in a territory of Dadal soum, a fishing camp in tributary part of Eg-Barkh river into Onon in a territory of Batshireet soum, and a big resort with a fishing camp in Khurkh-Onon delta in a territory of Binder soum. The camps of Degen Jidgen, Duruu, and Eg-Barkh are run seasonally and visited mostly by fishers from Czech and Slovakia. Khurkh-Onon camp in Binder soum is visited by Japanese tourists, who go catching and releasing of Taimen. However, the tour operators do not truly/accurately inform how many tourists and visitors they receive and details of taimen that are catch and release including their body lengths and numbers to local rangers.

In addition to tourists and visitors, local communities hunt Taimen in large amounts by using hooks and forks for household needs and do not provide any information on the fish they caught. According to the informal reports by local fishers, taimen with 100-160 cm lengths and 12-25 kg weights were caught several times from Onon river within Batshireet, Binder, Bayan-Adraga, and Dadal soums in 1990-2000, but very few taimen with 50-110 cm body lengths and 2-7 kg weights were caught in 2005-2007. These findings show that the taimen bodies and its population have been reduced in the river.

If reports on taimen caught and caught and released are obtained from the tour operators and local communities, it will be helpful in having more reliable data and information on taimen population and reserve that are needed for conservation.

Thus, Batshireet, Binder, Bayan-Adraga, Norovlin, Dadal, and Bayan-Uul soums should take the river parts, where the taimen population is distributed, under local protection and develop eco-tourism in accordance with related legal framework. It will be a beneficial for local (soum) socio-economic development.

Moreover, it needs to monitor movements of the fish species from Russia that were never recorded in basin for establishment of their distributions, locations, and movements. It will help in conservation of some game fish species populations in the basin.

It needs to systematically conduct studies on distribution and location of sturgeon listed in the Mongolian Red Book.

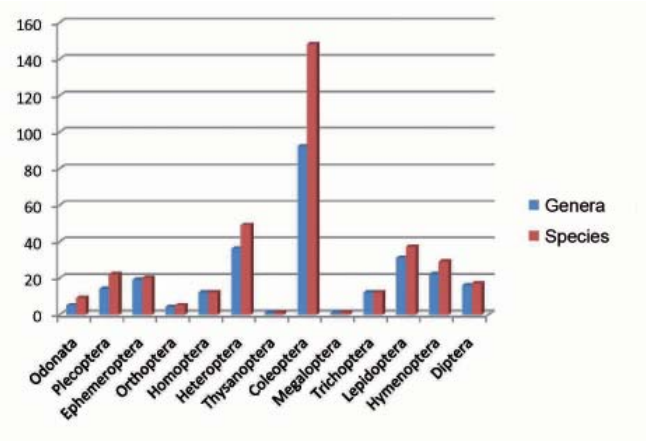
TEN. STUDIES ON INSECTS

Insects are recorded in all types of ecological habitats and biotops e.g. Onon River Basin vertical mountainous zone, dense and sparse forests, forest clearings, glades, edges, groves, mountain steppe, dry and wet meadows, river valleys, floodplains, and banks, river water, stagnant water, animals' wastes, holes, and carrions, rocks, and fallen trees.

Among the invertebrates, the insects are the most developed species that are well adapted to terrestrial habitats as their organism structures have become sophisticated during their historical development process. As their organism structures become more sophisticated, many species of insects are able to be distributed within a wide range of terrestrial areas based on their flying capacities. Since the insect populations are increased in huge numbers during their reproductions, they play an important role in metabolism process in the nature.

By compiling the data and findings of research materials and published articles and papers, we have identified 362 species of 265 genera of 109 families of 13 orders in Onon River Basin (Graph 10.1).

Graph 10.1. Diverse genera of insects recorded in Onon River Basin



Among the ecological groups of insects recorded in Onon River Basin, the forest damageable pests have been relatively well studied. This area/region is distributed by most of species that creae forests in Mongolia e.g. larch *(Larix sibirica),* pine *(Pinus silvestris),* pine *(Pinus siibirica),* spruce *(Pinus obovata)*, birch *(Betula platyphylla),* poplar (Populus tremula), aspen (*Populus laurifolia*), and elm (*Ulmus pumila*).

There are 151 species of 34 families that are fed by a variety of parts of these woody and bushy plants in the basin. Among the species, the beetle family is dominant. Species of *Lepidoptera* and *Diptera* orders are less in their populations, but their damages are higher compared to that caused by other orders. There are seven species abundant and 27 species that have common/regular distributions in the species population. Among them, the population of one species, Siberian silkworm (*Dendrolimus superans sibiricus*), has increased and found in permanent and temporary focuses.

ELEVEN. STUDIES ON VEGETATION COVER

According to the botanic-geographic province classification (A.A.Yunatov (1950)), the Onon River Basin lies in Ulz and Onon district of Ulz mountain steppe circle of central Khentii mountain taiga/boreal coniferious forest cirle, Uvur Baikal mountain taiga/boreal coniferious forest and Dahurian-Mongolian steppe province of Euroasian coniferious forest province. According to the classification on Onon river and its tributaries (N. Ulziikhutag, 1989), the river upper side lies in Khentii mountain taiga/boreal coniferous forest circle, when its eastern part lies in the Mongol Dahurian mountain steppe circle.

In Onon river valley, totally 332 species of 186 genera of 56 families are recorded and they constitute 38.92 per cent of total plants recorded in river floodplains in Mongolia.

In Onon River Basin, the 22.8% of total basin territory is pastureland including 6.8 % rocky, 22.9% bushy, and 3.65% hilly pastureland. Moreover, there are 3.01% of basin area is haymaking field, 1.07% farmland, and 39.05% forested area (Table 11.1).

Table 11.1. Current state of pastureland in Onon River Basin

Pasturelands	Area (ha)
Haymaking field	86728.017
Farmland	31017.059
Soum center	6071.836
Lake	1691.604
Forest	1123355.2
Others	10244.265
Pure pastureland	656312.54
Rocky pastureland	196901.4
Bushy pastureland	658958.82
Hilly pastureland	105181.62
	2876462.3

According to the pastureland and haymaking field classifications in Mongolia, there are pastureland of moderate high and low mountain dry steppe (8.4%), the mountain meadow (24.3%), the meadow valley between low mountains (3.7%), the steppe valley (10.4%), river valley in transition of zones and river valley-low depression meadow (8.5%). The 44.7 % of total basin area is forest and other types of land in use (Figure 11.1).

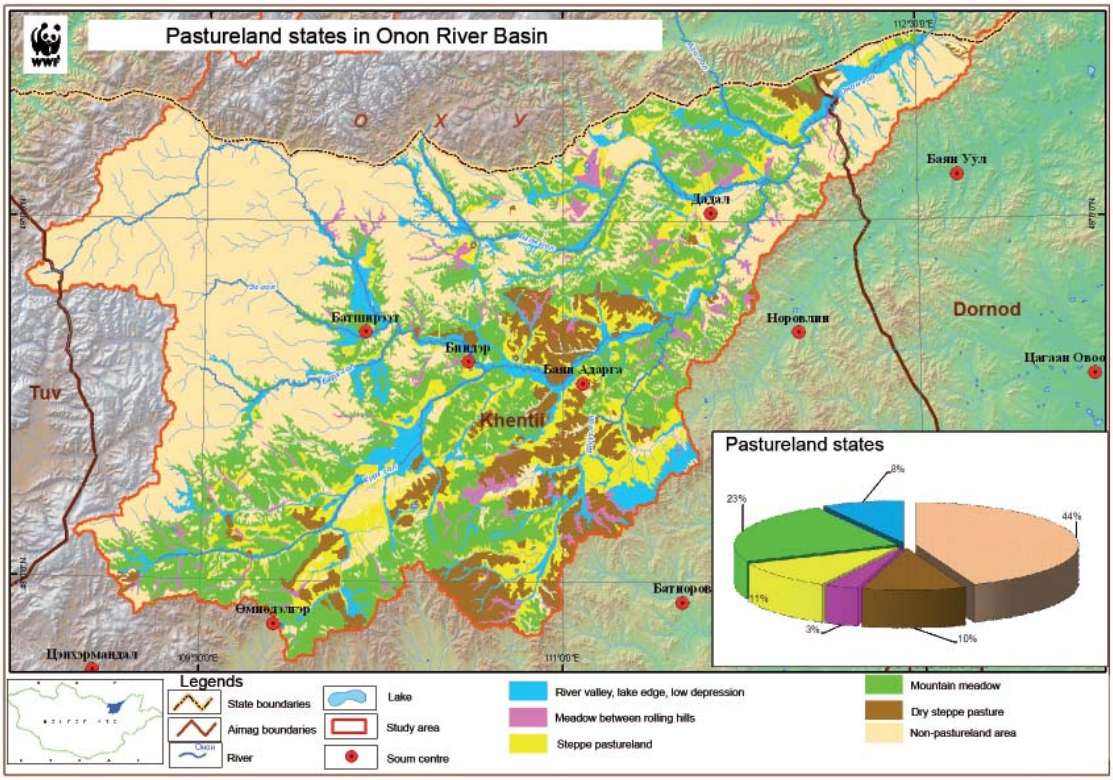


Figure 11.1. Pastureland states in Onon River Basin

Onon river valley is distributed by 301 pastureland species of 175 genera of 56 families, by 103 medicinal plants of 84 genera of 33 families, 48 weeds of 39 genera of 17 families. Among them, there are 19 rare species of 18 genera of 16 families and 19 very rare species of 18 genera of 16 families (Table 11.2).

Table 11.2. Specific features of vegetation in Onon River valley

Content classifications	Families	Genera	Species	Percentage
Pastureland plants	52	175	301	91.2
Medicinal and useful plants	33	84	103	31.2
Anthropogenic plants	17	39	48	14.5
Rare plants	16	18	19	5.76
Very rare plants	16	18	19	5.76

In Onon river valley, there are nine communites including rootstock grass, bunchgrass, grass-forb, sedge, forb, and small sedge and 26 communities including sedge, sedge-silk grass, sedge-forb, sedge, sedge-silk grass, sedge-forb, poplar aspen, aspen-poplar, grass-Artemisia-forb, small sedge-forb, and iris-grass.

In Onon river valley, totally 20590 ha of pastureland has been overgrazed at moderate level due to human and livestock inhabitance. Due to intensifying farming or cultivation in the basin, the distribution of annual Artemisia has become widespread by wind and overall pastureland state has been deteriorated.

There are rare and very rare plants (11.4%) that are threatened with extinction in the river basin. Thus, it needs to take the area under local protection in order to preserve natural condition.

TWELVE. STUDIES ON MAMMALS, AMPHIBEANS, AND REPTILES

There are totally 68 species of mammals including eight species of insectivores, six species of bat, four species of lagomorphs 27 species of rodents, 17 species of carnivores/predators, and six species of ungulate, six species of reptiles, and three species of amphibians recorded in Onon River Basin and its vicinity.

Amont the species recorded in the basin, there are Daurian hedgehog *(Mesechinus dauricus),* Eurasian otter *(Lutra lutra),* moose *(Alces alces),* red deer *(Cervus elaphus),* musk deer *(Moschus moschiferus),* wild boar *(Sus scrofa),* Siberian wood frog *(Salamandrella keyserlingii)* listed as endangered species in the Mongolian Red Book.

The Basin is distributed by 48.9% of mammals recorded in Mongolia. It shows that the Onon River Basin and its vicinity support diverse habitats and distribution ranges of mammals.

Habitats and distribtions of mammals, amphibeans, and reptiles of Onon River Basin are negatively impacted by the following factors:

- Illegal hunting and trade: game species or 27 species (35.6%) of mammals are highly affected by hunting. Particularly, the mammal species

e.g. Mongolian marmot (*Marmota sibirica*) and brown squirrel (*Sciurus vulgaris*), whose populations are drastically reduced and habitats are lost, are in the center of attention.

- Mining and gold exploitation: the distributions, habitats, and populations of small mammals are basically normal, but the habitats and distributions of the species nearby Gutai and Saikhan gold mines have been affected to certain extend according to the facts and data collected. In addition to the small mammals, the amphibeans and other species, whose suitable habitats are wetland, would be negatively impacted by the polluted water discharged by gold mining.
- Loss of habitates: it is necessary to protect and expand the habitats through rotational use of pastureland in Onon River Basin and its vicinity.

The buffer zone between Khan Khentii Strictly Protected Aera and Onon Balj National Conservation Park that are located in Onon River Basin provides a main corridor to mammals' movements. Thus, it needs to be included in the conservation zone of protected area. Overall, the conservation of entire trans-boundary regions through the establishment of a network between neighboring protected areas e.g. Khan Khentii and Onon Balj protected areas in Mongolia and Sokhondinskii SPA in Russia is vitally important for the fauna conservation.

Development of eco-tourism is one of most ideal economic activities for Khan Khentii and Onon Balj protected areas. Thus, it needs to revise the respective legal and regulatory framework with the provisions enabling the PA administrations to use and spend the incomes from tourism operations for the PA conservation management.

Since Onon River Basin is one of the areas that are specific with their natural formations and ecosystems, the comprehensive studies should be conducted in a form of regular monitoring. Eventually, it will provide a good opportunity to make it an exemplary or standard Protected Area Mongolia.

THIRTEEN. STUDIES ON BIRDS

Onon River Basin is the area, where the eastern edge of Khentii moungain range, the southern edge of Siberian taiga/boreal coniferious forest, and the northern edge of Eastern Mongolia meet. It is an important area that supports coniferious/decidous and broad leaved forests, Onon, Balj, and Khurkh rivers and lakes and ponds in their valleys, which provide an important habitats and distribution areas for birds.

There are 240 bird spceies of 133 genera of 47 families of 18 orders recorded in Onon River Basin and it constitutes 50.8% of the birds recorded in Mongolia. Among the birds recorded in the basin, there are 55 permanent residents and 185 migrants including 142 breeding species, 23 passengers, three species occationally recorded species, eight wintering species, and nine species spend their summer (but their whether they are breeding species has not been determined) in the basin [Tseveenmaydag 2008].

During our field trip, totally 106 bird species were recorded in study areas included four areas in forests, river valleys, and their vicinities. Among the birds recorded, there were quite many species recorded as endangered species in the Mongolian Red Book and CITES Appendices (Resolution No: 264 by the Government of Mongolia) (Table 13.1). According to our study findings, Onon River Basin is one of the important areas for conservation of endangered bird species and their habitats.

Endangered species not only nationwide but also worldwide e.g. Siberian crane *(Grus leucogeranus),* white-naped crane *(Grus vipio),* and great bustard *(Otis tarda)* are found in meadows of small rivers inflowing into Onon river and wet valleys that are distributed by willows and dense vegetations. Habitats and distribution areas of birds recorded in Onon river valley are negatively impacted by the following factors:

- Forest and steppe fires and tree cutting;
- Climate change particularly dryness and
- Pastureland deterioration.

According to our study findings, the bird conservation will be more efficeient if the important areas for bird breeding and nesting are freed of human and livestock inhabitance in May and June (offering local residents with opportunity to use the areas in other seasons) based on respective study or research findings since bird nesting and breeding process takes place in these months in Mongolia.

Meanwhile, it needs to conduct awareness raising activities/trainings including published materials on bird identifications among local residents particularly volunteerily interested in birds in order to regularly maintain census, observe and monitor bird populations and protect their habitats. If local people are appropriately trained and provided with updated information on bird identifications and their habitats, they will be able to work as bird watchers and guides for tourists and visitors.

One of the options to efficiently and properly use bird resource in Onon River Basin is to have the bird resource as a complement to eco-tourism. For instance, tributary rivers' valleys along Onon River Basin are the most suitable sites for obser-

Table 13.1. A list of endangered species recorded in Onon River Basin during our field trip

№	Species names	Legislations
1	Black stork *(Ciconia nigra)*	Mongolian Red Book, CITES Appendix 2, & list of rare species to Resolution No: 264;
2	Swan goose *(Anser cygnoides)*	Mongolian Red Book, list of rare species to Resolution No: 264;
3	Whooper swan *(Cygnus Cygnus)*	Mongolian Red Book, hunting has been banned since 1933;
4	Upland buzzard *(Buteo hemilasius)*	CITES Appendix 2;
5	Eastern harrier *(Circus spilonotus)*	CITES Appendix 2;
6	Steppe eagle *(Aquila nipalensis)*	CITES Appendix 2;
7	Golden eagle *(Aquila chrysaetos)*	CITES Appendix 2;
8	White-tailed eagle *(Haliaeetus albicilla)*	Mongolian Red Book, CITES Appendix 1;
9	Black vulture *(Aegypius monachus)*	CITES Appendix 2;
10	Falcon saker *(Falco cherrug)*	CITES Appendix 2;
11	Amur falcon *(Falco amurensi)s*	CITES Appendix 2, list of rare species to Resolution No: 264;
12	Eurasia kestrel *(Falco tinnunculus)*	CITES Appendix 2;
13	Siberian crane *(Grus leucogeranus)*	Mongolian Red Book, CITES Appendix 1;
14	Eurasian crane *(Grus grus)*	CITES Appendix 2;
15	White-naped crane *(Grus vipio)*	Mongolian Red Book, CITES Appendix 1;
16	Demoiselle *(Anthropoides virgo)*	CITES Appendix 2;
17	Great bustard *(Otis tarda)*	Mongolian Red Book, CITES Appendix 1, list of rare species to Resolution No: 264;
18	Little owl *(Athene noctua)*	CITES Appendix 2;
19	Eagle owl *(Bubo bubo)*	CITES Appendix 2;

vation of endangered e.g. cranes and great bustard and a number of wetland species. In addition to this, the groves and stands along Onon river are much suitable for watching forest and steppe bird species.

As the game species reserves and their usable amounts are appropriately established in the basin, it will provide the local residents to use them for household needs and the foreign hunters-tourists to go trophy hunting. Thus, it needs to immediately develop the management option to protect and use the game species reserve on sustainable way in cooperation with local communities. It needs to mark the breeding, nesting, and stopover points of not only nationally but also globally endangered species in Onon River Basin and specify conservation management options in Onon River Basin integrated water resource management pan.

FOURTEEN. LEGAL AND REGULATORY FRAMEWORK

Legal and regulatory framework for regulation of water related relations. The relations related to the conservation, sustainable use, and restoration of water and its basins are regulated by the Laws e.g. the Law on Water and other related laws including Laws on Mineral Water; Law on Water and Mineral Water Resource Use Payments, Law on Water Supply and Sewer Use in Urban Areas, Law on Prohibition of Exploration and Mining of Minerals in River Run-off Heads, Conservation Zones of Water Resource Areas and Forest Resource Areas, Law on the Portions to be spent from Natural Resource Use Payment Incomes for Environmental Conservation and Natural Resource Restoration, Law on Hydrology, Meteorology, and Environmental Monitoring, and Law on Water Transport, and the national program on Water approved by the Parliament Resolution No: 24 (2010).

Onon River Basin or Border Water Relations. In order to cooperate in terms of sustainable use, prevention from pollution and loss of water, information exchange, joint researches, and quality monitoring on trans-boundry basin water resources, Mongolia concluded agreements and treaties with its neighboring countries, Russia and China.

On February 15, 1995, an agreement “Conservation and Use of Border Water” was first made between the Mongolian and Russian Governments. Since then, regular meetings of authorized representatives of the countries have been held for the agreement enforcement and monitoring its performances. In the future, it is worthy to study the feasibility to consider Onon River Basin under the border water agreement and to reflect in the Basin management plan.

Integration of the rights and obligations of local institutions in the Basin. Due to lack of institutional structure and its human resources in charge of water issues at local level, the enforcement of the Law on Water is still inadequate. For instance, although the soum rangers are legally allowed to make agreements on water use, they do not make the agreements in practice because of their inadequate knowledge and education on environmental legislations, and their rights and obligations legally provided to them.

Therefore, the Onon River Basin Council

should closely cooperate with the State administrative central organization in charge of environmental issues, authorized government institution dealing with water issues, aimag/capital city Environment and Tourism Departments, aimag Citizen's Representative Khurals, aimag /capital city/ or soum Governors, water users, civil organizations, and professional institutions in order to ensure adequate enforcement of legally stated rights and obligations.

Funding: to date, there are 14 river basins already established in the country. Among these Basin Councils, the Khar Lake-Khovd river and Onon River Basin Councils have been established with support of WWF Mongolia. Other Basin Councils cannot basically run their operations due to lack of financing. In international practices, the funding required for implementation of integrated water reseource management is raised from the following sources:

- Water use payments and
- Water pollution penalties.

The Law on the Portions to be spent from Natural Resource Use Payment Incomes for Environmental Conservation and Natural Resource Restoration was approved in 2000. However, the enforcement of this "long titled, but short aged" Law is still missing/inadequate. The Law states that the 35 per cent of water resource use payment incomes will be used for funding of any water resource conservation and restoration related activities. This, in fact, is the legally stated funding source of the activities implemented in basins. Thus, it needs to clearly state the Basin Council funding sources in the Law on Water.

Additionally, Basin Councils will be provided with another funding source as the Law on Water Pollution Penalty, stated in Articl 30.4 of the Water Law, is drafted and approved.

International guiding principles used in water resources management. Guiding principles to be adhered in integrated water resource managment were identified and approved on the international conference "Water and Environment" held in Dublin, Irland, in 1992 follows:

1. Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment;
2. Water reseource management and development should be based on a participatory approach, involving water users, planners, and policy makers at all levels;
3. Women play a central part in the provision, management, and safeguarding of water;
4. Water has an economic value in all its competing uses and should be recognized as an economic good.

FIFTEEN CONCLUSIONS AND COMMENTS

Having conducted comprehensive water and ecological studies along Onon river and its tributary rivers e.g. Eg, Barkh, Khurkh, Shuus, Amgalant, Balj, Agats, and Kher, the study team has made the following conclusions and summaries:

- In 1954-2009, the annual average air temperature was increased by 2.09°C or the same rates of air temperature changes in Mongolia. It was increased by 1.98°C in summertime and 0.92°C in wintertime. Air temperature in Onon River Basin is getting increased almost by three times compared to the changes in air temperature of northern hemisphere of the globe. Regarding the precipitation, it was recorded as 300-375 mm in the basin, but it is likely to be 400-450 mm. It is likely to be warm in winters and more precipitation is expected. This tendency would intensify the dryness. Air temperature in Onon River Basin is getting increased almost by three times compared to the changes in air temperature of northern hemisphere of the globe.
- Due to overgrazing, top soil structure has been lost in quite large areas within Onon River Basin. Particularly, some parts of farmland or cultivation land in Khurkh bag of Umnudelger soum have been distributed by sand and small pieces of gravel/rocks. It shows that the areas are being affected by wind erosion. It needs to pay particular attentions to expansion of irrigated farmland and intensification of farming or cultivation production. The current cultivation practice, in which quite large areas are cultivated, but small yields or harvests are obtained, is not a solution in terms of ecological and economic values. This inefficient practice should be canceled/removed and comprehensive studies on irrigated farmland and soils should be conducted.
- It needs to plant juicy and silage plants that are required for intensive animal husbandry in irrigated farmland. It needs to take appropriate measures for increased livestock fodder supplies through the different options e.g. expansion of haymaking fields, use of fertilizers, and irrigation. These options will help in adequate supplies of hays and fodders not only within the region but also the neighboring aimags and soums.
- Exploitation of minerals makes certain contributions in regional economic development, however it negatively impacts on ecology. Due to mining operations, water is polluted, even some of water bodies are lost, water ecology is changed, wild species are moved away, and forests and plants are deteriorated and lost. Thus, mining operations should be prohibited in Onon River Basin.

- Rivers of Onon River Basin have fresh and soft water that is dominant with hydro-carbonate calcium, is less affected by negative human activities, and is in their natural states. However, in recent years, the run-offs of Khurkh and Shuus rivers are reduced and the water bodies have been polluted with livestock wastes and have lost their natural purification capacity due to livestock over-pollution in the basin in summertime.
- There are a number of hot and cold water mineral water bodies and fresh and salty lakes containing hot and cold water and carbonates/ carbonic acid gas throughout the Basin. It needs to take preventive measures against pollution and loss of the mineral water, lakes, and other water bodies under regulations.
- Main factors causing reduced forest resources and negative impacts on the forest ecosystem in the Basin are fires and damageable pests. Due to fires, considerable amounts of woods along with their bushy and herbal plants, wildlife species and their habitats are lost. Consequently, a number of wildlife species change their habitats and distributions, but several species of damageable pests have been distributed in burnt-out areas. As the pests are over-polluted in the burnt forests, they make the partially burnt woods totally destroyed. Meanwhile, due to increasing solar heat, the permafrost level is lowered and water in numerous rivers and streams have been reduced and dried up. As a result, the poplar and aspen stands growing along rivers are threatened with loss and extinction in quite many places according to our observations.
- Onon River Basin is distributed by a number of bird species that attract attentions of numerous individuals, who are interested in birds. Onon River Basin is one of internationally important sites for crane conservation. Thus, it needs to mark breeding, nesting, and stopeover points of globally endangered birds during their migration in Onon River Basin and specify the conservation options in Onon river integrated water resource management plan. One of the options to efficiently and properly use bird resource in Onon River Basin is to take the bird resource as a complement to ecotourism.
- The buffer zone between Khan Khentii Strictly Protected Aera and Onon Balj National Conservation Park that are located in Onon River Basin provides a main corridor to TURAG mammals' movements. Thus, it needs to be included in the conservation zone of protected area. The conservation of entire trans-boundary regions through the establishment of a network between neighboring protected areas e.g. Khan Khentii and Onon Balj protected areas in Mongolia and Sokhondinskii SPA in Russia is vitally important for the fauna conservation. Recent research findings show that area nearby Onon Balj delta is distributed by Eurasian otter (*Lutra lutra*) listed in the Mongolian Red Book. Thus, the area/habitat should be specifically protected. This type of conservation regime may be decided and managed with local conservation status.
- Water resource of Onon River Basin is 3737.25 million m^3, of which 3186.1 million m^3/ year is surface water of Onon River. As of 2009, only 1.73 million m^3 or 0.046 per cent of total Basin water resource was used. It shows that there is a good opportunity to develop and implement optimal management option for water consumption in the Basin.
- If it is regarded there are no impacts on ecological balance when usable water resource from the Basin is 965.36 million $м^3$ or 13 per cent of surface water resource, the 0.18 per cent of usable water resource in the Basin was consumed in 2009 and 0.26 and 0.59 per cent are expected in 2015 and 2021 respectively.
- Onon River Basin is rich in historical sites and homes of ancient Mongolians. Based on this advantage, it is possible to develop tourism in the Basin.
- In developed countries, the water ecology is completely changed in the vicinities of big cities as the rivers running along the big cities are usually straignthened and fenced on their sides. Thus, many foreign tourists and visitors come to see or enjoy untouched scenery including the rivers running in their natural conditions, the foreign researchers and explorers come to study the natural and untouched conditions including the rivers and lakes.
- Some types of soils that are rarely found elsewhere in the world is found in the basin. Thus, it provides an opportunity to establish an ecological and historical museum.
- Since rivers in Onon River Basin are still in their natural formations, not affected by technogenic impacts, it is possible to develop ecotourism in the Basin through preservation of these untouched conditions and ensuring natural and ecological balance and sustainability.

SOCIO-ECONOMIC SURVEY REPORT OF ONON RIVER BASIN

Main purpose of the survey: is to collect socio-economic data and information and to develop the justifications necessary for drafting an integrated water resource management plan for Onon River Basin (ORB).

Survey team: at a request of WWF Mongolia Programme Office, the survey was conducted by a team consisted of Dr. Sc (in Economics) and Professor A. Bakei represented the Research Centre of Agriculture, Environment, and Economics, Dr. Sc (in Economics) L. Nyambat, Dr. Sc (in Economics) B. Purev, MBA. D. Lkhagvasuren, and Ph. D student, D. Kadirbek.

ONE. UNIFIED LAND TERRITORY, HUMAN POPULATION, & EMPLOYMENT

Unified land territory: Unified land territory of ORB consists of: 1) land included in Protected Area buffer zone; 2) land not included in Protected Area buffer zone; and 3) others (land that is free of human and livestock settlements).

ORB supports 62.8 per cent of total territories of the soums included in the Basin. Of them: the 36.4 per cent is included in Protected Area (PA) buffer zone, the 62.1 per cent is outside the PA buffer zone, 1.5 per cent is land that is free of human and livestock settlements. According to the data stated in the land report produced by the Administration of Land Relations, Geodesy, and Cartography (2009), the 57.8 per cent of total territories of the soums included in ORB is agricultural land, the 27.4 per cent is forest resources land, the 14.0 per cent is land of special needs, and the rest or 0.8 per cent is water resources land, cities, villages, and other settlements' land, and road, transportation, and network land.

Table 1.1. Basin territory (in hectares)

№	Aimag & soums	Total territories of soums	Land included in River Basin	Of them: land pertinent to Protected Areas:			Land not included in ORB	Percentages of land in total soum territories
				Buffer zone areas	Non-buffer zone areas	Others		
1	Khentii aimag: Umnudelger	1088989.2	606940.0		606940.0		0.0	55.7
2	Batshireet	702439.7	702439.7		702439.7			100.0
3	Binder	543582.5	543582.5	291506.0	252076.5		0.0	100.0
4	Bayan-Adraga	301878.7	301878.7	105906.1	195972.6		0.0	100.0
5	Dadal	478323.0	478323.0	478323.0				100.0
6	Norovling	544966.8	65410.0	65410.0	0.0		104685.7	12.0
7	Tsenkhermandal	287398.7	21741.1	0.0	0.0	21741.1	0.0	7.6
8	Dornod aimag: Bayan-Uul	564177.1	111270.0	89746.0	0.0	21524.0	75137.2	19.7
	Total:	4511755.7	2831585.1	1030891.2	1757428.8	43265.1	179822.9	62.8

A source of information: based on data and records on land collected by WWF Mongolia Programme Office, 2009

Table 1.2. Onon River Basin forest resources land composition survey findings

Soums	Total areas (ha) of forest resources land	Forested areas											
		Total	Areas covered by forests					Areas not covered by forests					
			Total	Of them:				Total	Of them:				
				Naturally grown forests	Planted forests	Bushes & shrubs			Burned areas	Planted forests	Forestation conducted	Areas for forestation	Timbering areas
Bayan-uul, Dornod aimag	135708	123567	93864	87289	46	6529	29703	22470	2442	30	3863	898	
Batshireeet, Khentii aimag	593525	553913	419742	351312	-	68430	134171	114504	18735	-	135	797	
Bayan-adraga, Khentii aimag	33474	32613	19130	18757	-	373	13483	2458	10640	102	262	21	
Binder, Khentii aimag	180332	163712	126548	114530	49	11969	37164	17889	13804	-	5275	196	
Dadal, Khentii aimag	246237	219617	164402	146538	173	17691	55215	13035	36603	143	4389	1045	
Norovlin, Khentii aimag	79747	77732	58931	52932	-	5999	18801	3216	12417	-	1267	1901	
Umnudelger, Khentii aimag	526212	504731	409505	342443	-	67062	95226	64524	23938	-	6079	685	
Tsenkher mandal, Khentii aimag	21740	21740	21740	21740	-	-	-	-	-	-	-	-	
TOTAL	1816975	1697625	1313862	1135541	268	178053	383763	238096	118579	275	21270	5543	
Percentages in total amounts			100.0	86.4	0.0	13.6	100.0	62.0	30.9	0.1	5.5	1.4	

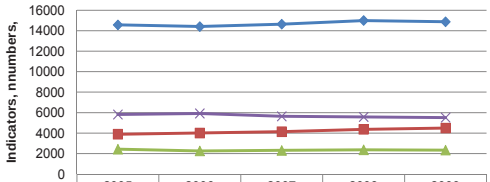
A source of information: based on data and findings from the survey conducted by the Government Implementation Agency-Forest Authority, 2008

According to the unified land territory composition, the Basin supports the land reserve that is ideal for development of animal husbandry, farming, tourism, and forestry from the main economic activities.

The most damageable and frequently occurred phenomenon that threatens Onon River Basin natural, ecological and economic conditions and causes negative impacts on natural pure water resources is the forest and steppe fires. According to the data on fires recorded in the Basin in 2004-2009, the causes of 56 per cent of total 75 fires occurred were not clearly identified, the 16 per cent of total fires occurred was trans-boundary fires from Russia, and the causes of 26 per cent of total fires were only identified to some extent.

Human population & employment: according to the 2005-2009 statistics, there were meanly 15.7 thousand people resided the Basin and mean annual population growth was 0.36 per cent. These findings show that the Basin population is likely to be increased.

Figure 1.1. Variations made in some human population indicators



	2005	2006	2007	2008	2009
Total population	14576	14411	14644	15000	14877
Total households	3889	4005	4131	4365	4487
Total herder households	2431	2259	2312	2370	2339
Total employed people	5816	5921	5643	5581	5510

No specific changes are seen in the rest of demographic indicators. For instance, according to the average five year findings, the Basin was resided by totally 4,175 households including 2,342 (56.3%) herder families and total 5,694 employed individuals including 4,781 (84%) herders. These findings show that the economic activity that provides for main livelihood source for the Basin human population is the animal husbandry.

According to the statistics (2009), the 84 per cent of total employed people throughout the Basin was in the agricultural sector and about 10 per cent in the public services e.g. education, health, social welfare, and public administration. These findings show that no actual employment and job opportunities are specifically created in other economic sectors e.g. industries and tourism. Unemployment rate is relatively high namely 3.0-3.9 per cent in average in the Basin soums. Therefore, it needs to raise and implement the objectives to develop small and medium enterprises e.g. livestock raw material processing and making timber-works or crafts and tourism sector.

Industry and enterprise development: in the current situations, the soums situated in the Basin are being connected to the central energy network and favourable prerequisites for development of enterprises are created through the State policies and considerable investments on small and medium enterprise development. As these favourable conditions are created at local level, the implementation of the objectives above mentioned is being just started in the soums. For instance, small enterprises and workshops e.g. timber-work (Binder & Bayan-Uul), dairy products (Bayan-Adraga, Batshireet, & Dadal), ger frame making (Umnudelger), fruit planting (Batshireet), flour mill (Bayan-Adraga), concrete block making (Norovlin), bakery (Dadal & Bayan-Uul) are established and started their businesses. In addition to these enterprises, the meat processing, felt works and small workshops of sewing have been opened and run in some soums in the Basin.

Table 1.3. Enterprises & economic activities ideally to be developed in the soums based on their existing advantages

№	Soums	Enterprises to be ideally developed in the soums
1	Batshireet, Khentii aimag	Sour cream, cheese, log-house or cabins (log frames), meat, & paper making;
2	Bayan-Adraga	Flour, dairy products, timber-work, & livestock fodder;
3	Binder	Bakery, sour cream, timber-work, livestock fodder;
4	Dadal	Sour cream, fruit planting, bee honey, & timber-work;
5	Norovlin	Flour, bakery, mineral water, & dairy products;
6	Umnudelger	Milk, boards/wooden, ger wooden frames, wool, livestock fodder, & meat;
7	Bayan-Uul, Dornod aimag	Timber-work & bakery;

In addition, to the animal husbandry, each soum in the Basin should seek for opportunities to develop the following enterprises as stated below in order to increase non-livestock income generation sources within its territory:

- Batshireet: dairy products + timber work + meat processing;
- Bayan-Adraga: crop + flour + timber work + livestock fodder;
- Binder: farming + bakery + timber work + sea buckthorn;
- Dadal: farming + tourism + dairy products + bee farm;
- Norovlin: farming + flour + mineral water- resort;
- Umnudelger: tourism + farming + dairy products + ger wooden frame + wool;
- Bayan-Uul: timber work + farming + dairy products.

Table 1.4. Some indicators of tourism industry

№	Tourist camps, economic entities	Establishment & locations	Capacities	
			gers	beds
1	"Bayangol" camp, "Khan Khentii Travel" LLC	Salkhit Khutul area of Bayanzurkh bag, Umnudelger soum, Khentii aimag	5	15
2	"Chinggisiin Toonot" camp, "Chinggisiin Toonot" LLC	Ulaan Undurl-ugiin Ar area, bag 3, Binder soum, Khentii aimag	9	32
3	"Gurvan Nuur", "Chinggisiin Gurvan Nuur" LLC	At 3 km from the Dadal soum centre, Khentii aimag	13	28
4	"Onon Balj", "Shijir Bill International" LLC	At 1 km from the Dadal soum centre, Khentii aimag	11	40
5	"Jamuha", "Baljkhai" LLC	Bag 5, Binder soum, Khentii aimag	7	20
6	"Bogol", "Bogol" LLC	Bag 4, Binder soum, Khentii aimag	4	12
7	"Onon Yol", "LETSO" LLC	Onon bag, Batshireet soum, Khentii aimag	8	32
8	"Yaviin Bulag", "Yaviin Bulag" coop-erative	Bag 4, Umnudel-ger soum, Khentii aimag	3	10
9	"Khangal", "Khan Khentii Travel" LLC	Bag 2, Umnudel-ger soum, Khentii aimag	10	45
	Total		70	234

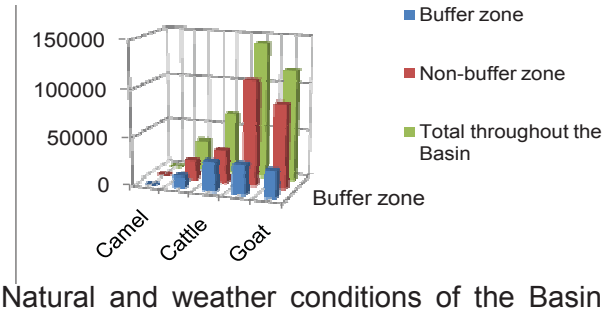
A source of information: Reference Book on Tourism Service Organizations, Ministry of Nature, Environment and Tourism, 2010.

In the future, it needs to implement a comprehensive programme on development of tourism products e.g. offering visits to families for acquaintance with nomadic life styles and cultures and historical and cultural sites, travel by horse and hiking, water trips, and resort based on the naturally beautiful areas and ideal tourism sites including Soogtiin cave, Tseentei mountain, Unurch-Ulaarzgana, Bayankhaan mountain, Sant Khaan mountain (Dadal soum), Baljiin Tsagaan Tolgoi (situated at the junction of Binder and Dadal soum territories), Ikh Nuur, Naadmiin Nuur, Khurkhree Nuur (Dadal soum), and Khustai & Narstai (Bayan-Uul soum of Dornod aimag and Norovlin soum of Khentii aimag) in the Basin.

TWO. OUTLINE ON SOCIO-ECONOMIC DEVELOPMENT: AGRICULTURE

Livestock numbers, locations, & compositions. Statistics on livestock raised throughout the basin (2005-2009) show there were meanly 356.2 thousands or 791.0 thousands in sheep unit raised in the Basin. Among them, the 30 per cent of total livestock herds resided within the PA buffer zone and the 70.0 per cent in non-buffer zone in the Basin (Figure 2.1). According to the average five year statistics, there were 52 sheep unit heads of livestock per 100 ha in the Basin. However, it was increased up to 64 sheep unit heads in 2009.

Figure 2.1. Numbers of livestock throughout the Basin



Natural and weather conditions of the Basin are much suitable for raising cattle, horse, and sheep. Accordingly, these livestock herd structures that are matched to the natural and weather conditions have been formed and run for years within the Basin. However, in recent 20 years, a drastic change in the herd structures has been made as local herders have had an interest to raise more goats in connection to the increasing cashmere market prices. Thus, the livestock herd structures in the soums vary. For instance, the herd structures in sheep unit in the soums show in the given sequences as follows: number of cattle-horse-sheep-goat is raised in Batshireet, Binder, Bayan-Adraga, and Norovlin soums; cattle-sheep-horse-goat-camel in Umnidelger soum; and cattle-horse-sheep-goat in Dadal and Bayan-uul soums. According to the actual heads of livestock in the soums, Umnudelger, Binder, Bayan-Adraga, and Norovlin soums have herd structures of sheep-goat-cattle-horse; Batshireet soum sheep-cattle-goat-horse; Dadal soum cattle-sheep-goat-horse; and Bayan-Uul soum goat-sheep-cattle-horse in the given sequences.

Figure 2.2. Livestock herd structure throughout the Basin

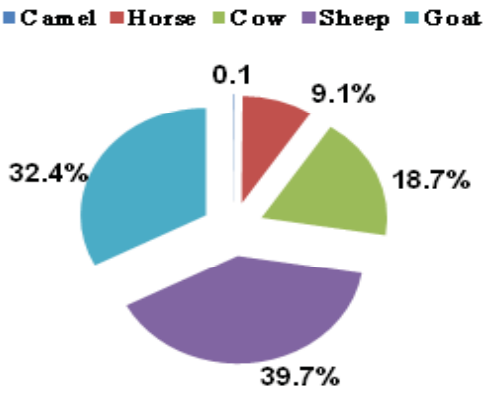


Figure 2.2. Shows the livestock herd structures throughout the Basin. Percentages of goats in herd structures in the soums in the Basin are 42.1% in Umnudelger, 35.6% in Norovlin, 35.3% in Bayan-Adraga, and 34% in Bayan-Uul soum. These are not appropriate or acceptable percentages.

Pastureland carrying capacities. As of 2009 end, there were 15,861,000 heads of livestock in sheep unit in the Basin. These numbers of livestock exceeded the acceptable pastureland carrying capacities in droughty years by 13.6-87.1 per cent and the winter and spring pastureland carrying capacities in ordinary or regular years by 39.0 per cent. However, the current heads of livestock do not exceed the summer and autumn pastureland carrying capacities of regular or pleasant weather conditioned years. Among the soums, the pastureland carrying capacities in Batshireet and Norovlin soums are exceeded for now.

Access to pastureland is enough for Dornod aimag, but the pastureland carrying capacity in Khentii aimag would be exceeded particularly in droughty years. Overall, the pastureland throughout the Basin is overgrazed abundantly and considerable changes are made to vegetation compositions as many people critically view. Thus, specific measures or actions should be undertaken with this regard as we recommend.

Table 2.1. State of pastureland carrying capacities throughout the Basin

№	Aimag, soum	Heads of livestock (2015)		Heads of livestock (2021)	
		total	per hectare	total	per hectare
1	Umnudelger	210889.6	0.7	170017.1	0.6
2	Batshireet	101027.4	0.8	78860.2	0.6
3	Binder	254686.9	0.7	252928.7	0.6
4	Bayan-Adraga	159817.4	0.6	172291.0	0.7
5	Dadal	99158.7	0.6	114561.7	0.7
6	Norovlin	52391.4	0.4	83911.8	0.7
7	Bayan-Uul	39594.7	0.4	73267.1	0.7
	Amount	940731.7	0.6	945837.6	0.6

As the increase in livestock heads is likely to cause deterioration and loss of pastureland carrying capacities in the Basin, it needs to improve livestock breeds, qualities, and herd structures in the future. In relation to these needs, it needs to pursue the policy to restrict or not to increase the numbers of livestock, particularly numbers of goats while sticking to the current rates and numbers of livestock in the Basin. Upon the consideration of these actual needs, it is necessary to raise particularly the best breeds of cattle. According to the projection or statistics, the numbers of cattle are likely to reach 73, 708 including 4,931 heads of best breeds in 2015 and 75323 including 8361 heads of best breeds in 2021.

Animal husbandry and its production. According to the average production rates in last five years, totally 170.2 thousand tons of wool and cashmere, 16.7 millions litres of milk, and 17.5 thousand tons of meat were produced throughout the Basin and the production amounts were increased from year to year. However, the livelihood and incomes of herders are not appropriately improved due to lack of optimal network of livestock product supplies to domestic and foreign markets. Therefore, it is necessary to create and develop the network to directly deliver the raw materials of livestock to respective consumers through locally established herders' cooperatives.

Farming and its production. One of primary economic activity at basin level is farming and its production. Throughout the Basin, there are 26.4 thousands hectares of farmland. The 15.1 per cent of the total farmland is planted with crops, the 0.6 per cent with potato and other kinds of vegetables, the 9.3 is ploughed, and the 75.0 per cent is abandoned. These findings show that the farmland reserves in the Basin are inadequately used for the production. Land reserves in Umnudelger, Dadal, Binder, Bayan-Adraga, and Norovlin soums are potential for farming.

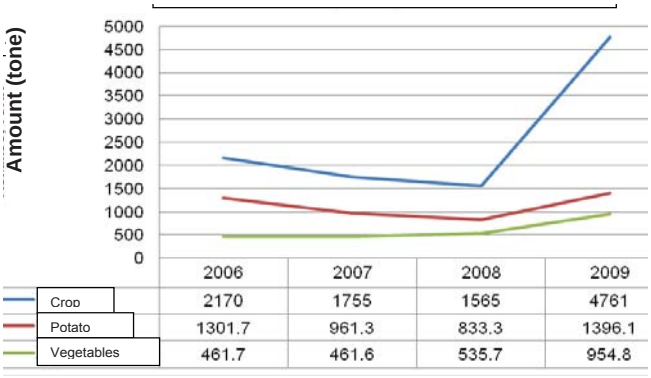
Basically, farming business is engaged at household level, but very few large scaled producers, throughout the Basin.

Table 2.2. Pastureland carrying capacities throughout the Basin (in sheep unit, as of 2009)

No	Aimag, soum	Head of livestock (2009)	In droughty years		In typical years		In pleasant weather conditions	
			winter, spring	summer, fall	winter, spring	summer, fall	winter, spring	summer, fall
	Basin							
1	Umnudelger	516.4	162.1	316.1	218.3	425.9	319.5	625.8
2	Batshireet	144.7	42.8	80.7	57.6	108.7	84.3	159.7
3	Binder	280.5	93.0	320.7	125.3	432.0	183.3	634.8
4	Bayan-Adraga	159.5	108.5	155.1	146.1	209.0	213.9	307.1
5	Dadal	97.0	95.5	85.9	128.7	115.7	188.3	170.1
6	Norovlin	211.5	103.5	334.6	139.3	450.8	203.9	662.4
7	Bayan-Uul	176.4	242.2	103.2	326.1	139.0	177.3	204.2
	Amount	1586.1	847.6	1396.3	1141.3	1881.1	1670.7	2764.0
	Aimags							
1	Khentii	3810.5	2057.0	3504.4	3769.9	4721.1	4054.5	6937.2
2	Dornod	2903.7	3957.3	5149.6	5328.6	6937.7	7799.8	10194.2

There are few companies that have relatively larger farmland e.g. “Khurkh Gol” (Umnudelger) with 3000 ha of rotationally used farmland and “Munkh-Onon” (Bayan-Adraga) with 1,600 ha of farmland. In addition to these companies, there are nine economic entities running their farming business in 200-400 ha of rotationally used farmland in the Basin.

Figure 2.3. Farming production



Overall, farming and its production is likely to increase starting from 2008. It might be positively impacted by the State support policy on the sector in the country.

According to our survey findings, the 86.9 per cent and 13.1 per cent of yields of crops per a hectare within Khentii aimag are likely to be impacted by weather conditions and human factors respectively. Therefore, it needs to design and implement the objectives to develop irrigated farming that uses advanced technologies, which well work in the current climatic changes, to completely and efficiently utilize the farmland as much as possible, and to strengthen the livestock forage base supplies in ORB through planting fodder plants. Moreover, the surveys on soil fertility in abandoned and used farmland in each soum should be conducted by professional institutions for assessment; not less than 60 per cent of the land that is suitable for farming should be utilized; special breeds of cattle should be raised for milk-meat purposes, and farm production should be expanded through planting juicy fodders (nutritive turnip and other silage plants), green fodder made of perennial plants (e.g. alfalfa). In other words, it needs to intensify the farming sector and simultaneously to direct and use specific parts of its capacities for intensified animal husbandry development.

THREE. OUTLINE ON SOCIO-ECONOMIC DEVELOPMENT: MINING

At the moment, no large scale mining is undertaken within the Basin territory. However, there are three gold, two iron, and five coal deposits, whose reserves are identified by respective professional institutions in Khentii aimag.

There are also a number of economic entities issued with exploitation and exploration licenses mostly for small sized (small reserved) gold deposits in the Basin.

Currently, gold panning from a mine is carried out in Saikhan river of Umnudelger soum and a gold mining in Gutai area in Batshireet soum has been started, but its operation has not been stabilized.

Table 3.1. Mineral exploitation and exploration licenses issued and their locations within the Basin

Soum and bag	Licenses			
	Issued to the soum		Of them: issued to ORB	
	numbers	area (ha)	numbers	area (ha)
One. Exploration licenses:				
Batshireeet, Khentii	20	166317.7	20	166317.7
Bayan-adraga, Khentii	9	32118.64	9	32118.64
Binder, Khentii	13	80964.18	13	80964.18
Dadal, Khentii	8	22812.7	7	20623
Onon Bag, Norovlin, Khentii	3	6663.68	2	303
Umnudelger, Khentii	32	260425	24	226803
Sub-total	85	569301.9	75	527129.52
Two. Exploitation licenses:				
Batshireeet, Khentii	3	687.68	3	687.68
Bayan-adraga, Khentii	1	27	1	27
Binder, Khentii	1	12	1	12
Dadal, Khentii	1	93	1	93
Umnudelger, Khentii	6	4511.51	3	3978.51
Sub-total	12	5331.19	9	4798.19
Total:	97	574633.09	84	531927.71

In the Basin, there are totally 84 mineral licenses including 75 exploration and nine exploitation licenses. Total areas with exploitation and exploration licenses are 531.9 thousand hectares that are equal to 21.4 per cent of total ORB territory.

Since ORB is rich in historical and cultural heritages and traditions and naturally beautiful areas, these features might be restrictive factors for the mining development operations and no specific projection on the mining as a main economic activity for the Basin is seen. In this line, it needs to ensure adequate enforcement of the Law on Prohibition of Mineral Exploration and Exploitation within the Forest Resources Zone and Conservation Zone of Heads of Rivers and Water Resources Land approved by the Parliament in 2009.

FOUR. THE BASIN ECONOMIC DEVELOPMENT TENDENCY

At present, the agriculture and its production is dominant (74%) in the gross domestic products (GDP) of the Basin. This sector is followed by trade (5%) and industry/ enterprise, energy, and construction (2%) from other economic activities in the Basin.

Human population in the Basin is likely to reach 16.6 thousands in 2015 and 18.2 thousands in 2021. As the service sector e.g. tourism and processing enterprises are appropriately developed, the GDP composition will be notably changed. The agricultural and forestry products in the GDP are likely to provide for 74.2 per cent in 2015, but 55.9 per cent in 2021. The rates of service sector are likely to be 23.8 per cent in 2015 and 40.6 per cent in 2021. As a result, the annual added value rates are likely to be increased by 7.5 per cent in average and amounts per a capital would reach MNT 1.1 millions in 2015 and MNT 1.7 millions in 2021.

Table 4.1. Development tendency of main economic sector

№	Descriptions		2009	2010	2015	2021
One. Human population & employed people						
1	Total population		15944	15964	16590	18156
2	Total employed people		5142	6179	6519	7550
	Of them:	Agriculture	4806	4764	4543	4002
		Industrial sector	96	104	147	210
		Service sector	1239	1312	1829	3337
Two. Value added production (MNT, millions, as 2005 rate)						
1	Agriculture		11486.0	11876.6	13923.7	17448.2
2	Industrial sector		88.5	113.3	364.9	1100.2
3	Service sector		1621.5	1919.0	4469.8	12654.2
4	Total added value		13196.1	13908.9	18758.4	31202.6
5	Added value per capita		0.8	0.9	1.1	1.7

Main immediate objective of the Basin is to move from the one economic activity focused inward-looking structure to the multiple economic activity covering structure. While the annual water consumption by human population and livestock in the Basin is 86.8 millions litres and 931.6 millions litres respectively, the 1.5-2.0 millions m^3/ha is expected to be needed for farming.

CONCLUSIONS & COMMENTS

1. The unified land territory composition and natural resources in the soums in ORB provide for basis and opportunities to develop animal husbandry, farming, tourism, and some processing enterprises in the basin.
2. Since the soums in the Basin support the heads of livestock that exceed their pastureland carrying capacities, it needs to implement pastureland overgrazing and deterioration prevention management at the Basin, soum, bag and herder community levels through restricting the numbers and growth of non-quality livestock, increasing heads of high quality livestock breeds, and improvement of overall livestock breeds.
3. It needs to set up more favourable conditions for complete and efficient use of farmland including abandoned plots, expansion of farming business with support of advanced technology based irrigated farming, and prevention from potential livestock risks through planting livestock fodder plants.
4. Based on their advantages, the soums in the Basin should produce and supply their brand products that are competitive at local and regional markets through their cooperation in specialized businesses and small and medium enterprises e.g. processing of livestock raw materials, timber-work and dairy product making.
5. Through producing and implementation of comprehensive tourism development programme, it needs to develop the tourism sector as one of the main economic activities of the soums in the Basin.

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To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony and nature.